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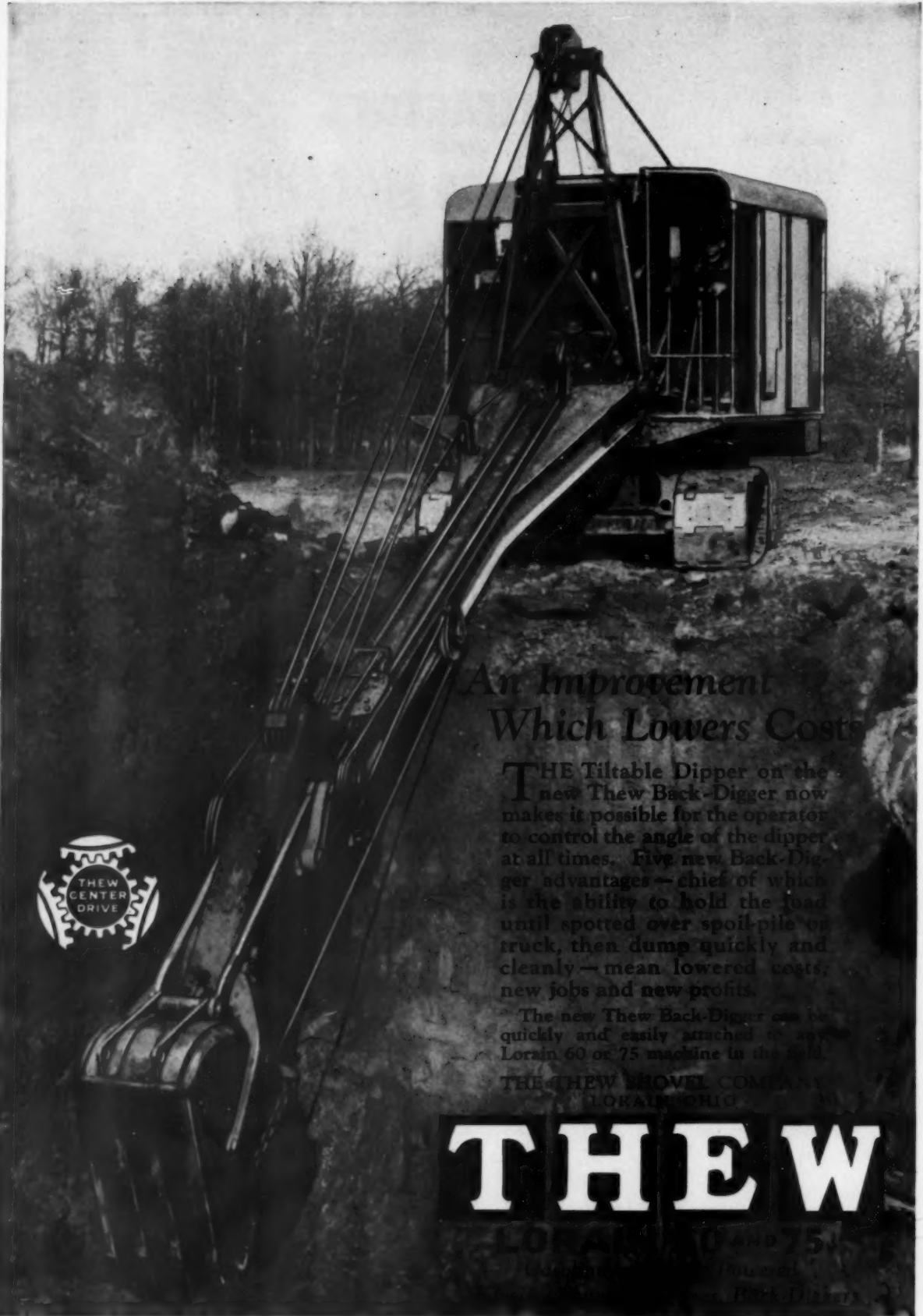
Contractors and Engineers Monthly

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An Improvement Which Lowers Costs

THE Tilttable Dipper on the new Thew Back-Digger now makes it possible for the operator to control the angle of the dipper at all times. Five new Back-Digger advantages—chief of which is the ability to hold the load until spotted over spoil-pile or truck, then dump quickly and cleanly—mean lowered costs, new jobs and new profits.

The new Thew Back-Digger can be quickly and easily attached to any Lorain 60 or 75 machine in the field.

THE THEW SHOVEL COMPANY
LORAIN, OHIO

THEW

LORAIN 60 AND 75

Back-Diggers

Volume XVI
Number 5

Contractors and Engineers Monthly

May,
1928

Developing and Operating a Crushed Stone Plant

By Arthur C. Avril

Mining Engineer, The France Stone Co., Toledo, Ohio



FIFTEEN or twenty years ago the crushed stone industry was very crude. Success depended solely on the volume of sales. Increased profits from improved efficiency of the plant were almost entirely neglected. The rapid growth in motor transportation brought about the building of extensive highway systems,

rigid specifications for crushed stone were drawn up and the old school crushed stone plant became obsolete.

Instead of the plant superintendent being of the rough and ready type, who was always alert to fight with his men and brow-beat them into doing their duties, he is now a thinker, who spends most of his time devising methods of increasing plant efficiency, improving the quality of the finished product, promoting co-operation in his organization, and seeing that safe practices are carried out at all times. Engineers of all types have been injected into the organizations, a Safety First Department, a Research and Geological Department, an Agricultural Department and numerous others are not uncommon in the crushed stone company of today. These developments are due to the realization that long life in the industry demands a satisfactory product.

In this article the different stages of development of a stone property are followed through chronologically, assuming that the installation of an entirely new operation is the problem to be considered.

SURVEY TO LOCATE DEPOSIT

The first department called upon is the Geological Department. The geologist receives instructions that a specific market is not being economically supplied with crushed stone. He is asked to make a survey of the territory to try to find good stone deposits. He spends several weeks in the field making a general survey. He considers the different locations he finds, from the standpoint of quality, depth of overburden, accessibility to rail transportation, market possibilities and other vital details. After completion of the field work, he prepares a preliminary report, in which he makes recommendations giving detailed reasons as to which prop-

erty is the best one to consider.

If the proposition as reported looks attractive he is given authority to verify the preliminary survey by core drilling the property.

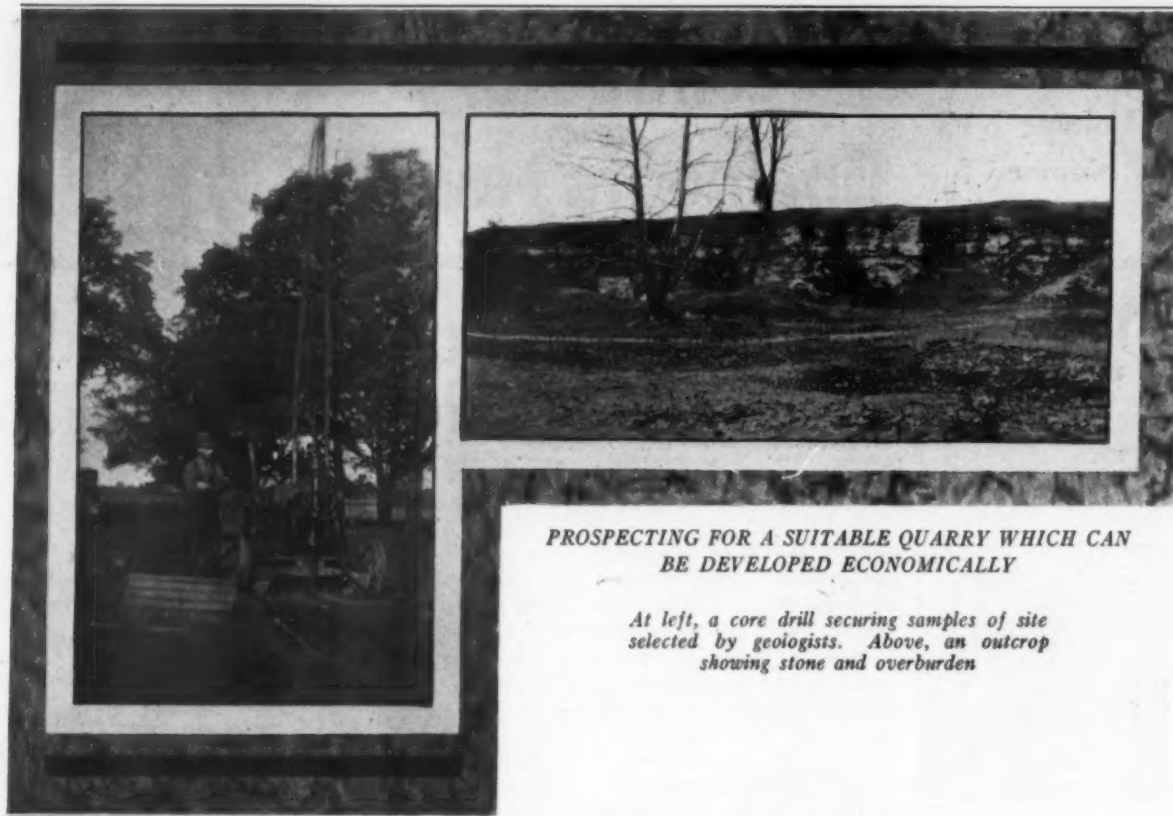
The property is thoroughly cored and complete records made of depth of overburden, thickness of stone beds, kind of stone and the thickness of the stratification. The cores are then sent to the laboratories to be tested, both for physical and chemical properties, to determine into what markets the material could be introduced. A complete report is then written covering the geological test, market and production data in detail. It is submitted to the directors, and if found satisfactory, preparations for opening a plant are begun.

At this point the Operating, Engineering, Traffic and Sales Departments begin their work. The Operating and Engineering Departments lay out the property to take care of quarry, building, location, storage, etc., and they design and build the mill for the recommended capacity. The Traffic Department establishes freight rates to the probable markets and the Sales Department starts out for business. After the geological report has been made it is safe to estimate that a plant can be built and ready for operation in about eight or ten months.

STONE TESTING EQUIPMENT AND TESTS

The standard tests—to determine the physical quality of stone—are for hardness, toughness, per cent of wear, soundness, absorption, and specific gravity. To determine the chemical qualities, stone is analyzed for the quantities of calcium carbonate, magnesium carbonate, silica, iron, alumina, sulphur, phosphorus and free carbon.

Hardness—The equipment necessary to test for hardness consists of a rotating disc covered with standard Ottawa silica sand. Two kilogram weights carrying a stone sample one inch in diameter ride on guides upon the rotating disc. A grinding action between the stone sample and the sand-covered disc takes place. One thousand rotations constitute a test. The hardness factor is determined by taking one-third the difference in weight of the sample before and after being in the machine, and subtracting it from twenty. The result is the hardness factor. For the stone to be grade A, specifications require a hardness of not less than 14.



PROSPECTING FOR A SUITABLE QUARRY WHICH CAN
BE DEVELOPED ECONOMICALLY

*At left, a core drill securing samples of site
selected by geologists. Above, an outcrop
showing stone and overburden*

Toughness—The toughness of rock is the resistance offered to fracture under impact and is accomplished with a machine that consists of a 50-kilogram base, a hammer weighing 2 kilograms, which falls between two guides and is made to fall 1 centimeter the first blow, 2 centimeters the second blow, etc. The height of fall in centimeters at failure indicates the toughness. A cylinder of stone 1 inch in diameter and 1 inch long is used as the sample. Specifications require a toughness of not less than 5.

Wear—The Deval abrasion machine is used in determining the per cent of wear or French coefficient of the stone. The machine consists of one or more hollow iron cylinders, closed at one end and furnished with a tightly fitting iron cover at the other; the cylinders are 20 centimeters in diameter and 34 centimeters in depth inside. They are mounted on a shaft at an angle of 30 degrees with the axis of rotation of the shaft. The test consists of placing 50 pieces of stone—broken as nearly cubical as possible and weighing within 10 grams of 5 kilograms—into the cylinder, which is then sealed at the open end. Ten thousand revolutions at 30/33 per minute constitute a test. The cylinders are then emptied and thoroughly cleaned out. Everything retained on a 1/16-inch square mesh screen is weighed to determine the percentage lost. The difference between this and the original weight in percentage is called the per cent of wear. To be classed as Grade A, specifications require a stone to have a per cent of wear of not more than 6.

Soundness—To determine the soundness, or weather resisting properties of stone, ten pieces having a total weight of 1,000 grams are immersed in a saturated

solution of sodium sulphate (Na_2SO_4), at 70 degrees Fahrenheit, for twenty hours, after which they are placed for 4 hours in a drying oven maintained at 100 degrees Centigrade. This is repeated five times, and if no checking, cracking or marked disintegration is noted, the stone is considered of Grade A quality.

The chemical tests are accomplished with the usual chemical laboratory equipment, consisting of glass ware, balance gas burners and chemicals.

To make laboratory screen tests, a standard set of Tyler screens is used. To make the separations, the screens are nested and clamped into a "Ro-Tap" shaker, and allowed to shake for a specified length of time.

Another very essential piece of equipment in a stone testing laboratory is a hydraulic or mechanical compression testing machine. This piece of equipment is used to test the compressive strength of concrete. The standard concrete cylinder tested is 12 inches in length and 6 inches in diameter. The result is given in pounds per square inch, and is computed by dividing the total load applied to break the cylinder, by the area of the top of the cylinder in square inches.

There are many more pieces of equipment which can be used in a stone testing laboratory, such as transverse machines to test the cross-breaking strength of concrete, machinery to make tensile strength tests and equipment used in preparing samples.

A TYPICAL CRUSHED STONE OPERATION

When the tests are completed, plant track and quarry layouts are made, freight rates established, and the enterprise is ready for the construction of buildings and the opening of the quarry hole. While the mill is under

construction and the tracks are being laid, the overburden is removed to uncover enough stone to allow an efficient quarry operation. The stone is then drilled for blasting, by using either well drills or air hammer drills mounted on wheels. The choice of drill depends upon the nature of the rock. For thinly stratified or fractured stone the well drill is the more efficient. For heavily bedded even structured stone the air drill is the more efficient. Another important governing factor in the choice of a drill is the depth of the cut in the quarry. Well drills are suitable for any depth of face, but the maximum efficient depth to which the air drill can drill is about 20 feet.

Well drills commonly used are Armstrong, Loomis and Cyclone drills. Air drills adaptable to this work

are Ingersoll-Rand, Chicago Pneumatic and Sullivan drills.

It is difficult to give a definite description of blasting in a quarry, because each one, to obtain efficient results, is an individual problem and can be solved only on experiment. Depending upon the nature of the rock, thickness of the strata and depth of the face, explosives ranging from 30 to 60 percent gelatine or ammonia dynamite are used. Very little black powder is used because it does not have a violent enough action to shatter the stone so that it can be crushed and prepared economically.

In a large quarry operation heavy-duty steam or electric shovels, usually of the Marion No. 91 or large Bucyrus type mounted on crawlers or tractor wheels and



SCENES AT THE MONROE QUARRY OF THE FRANCE STONE CO.

1. General view of quarry, showing the quarry and shovels.
2. The car hoist.
3. The electric motor and Texrope drive for the No. 21 crusher.
4. Top of the large pan conveyor.
5. The revolving screen showing its electric drive.
6. The speed reducer showing the motor driving the revolving screen. Notice the totally enclosed motor with ventilation pipe.

equipped with a $3\frac{1}{2}$ -yard bucket, are used.* Railroad type shovels are almost obsolete in present-day quarry operation. Ease of manipulation and the saving of labor have brought about the change from railroad type shovels to the other two.

The shovels each load about 125 tons per hour into

* The writer wishes to make it clear that each piece of equipment described in this article is merely a typical example, and was not used because of some merit it may have over any other make. The typical plant described is the new Monroe Plant of the France Stone Co.

side dump, steel quarry cars. At Monroe, a Koppel car with a level capacity of 9 cubic yards is used. It will carry 11 cubic yards heaped, has 4-foot $8\frac{1}{2}$ -inch gage trucks, measures 15 feet 1 inch over coupler pulling faces, has a 6-foot, 3-inch wheel base, is 10 feet wide and 7 feet 9 inches in height. They are arranged to discharge from either side. Forty-ton Vulcan steam locomotives furnish the motive power for drawing the cars. The trains travel from the face to the foot of the in-

FLOW SHEET

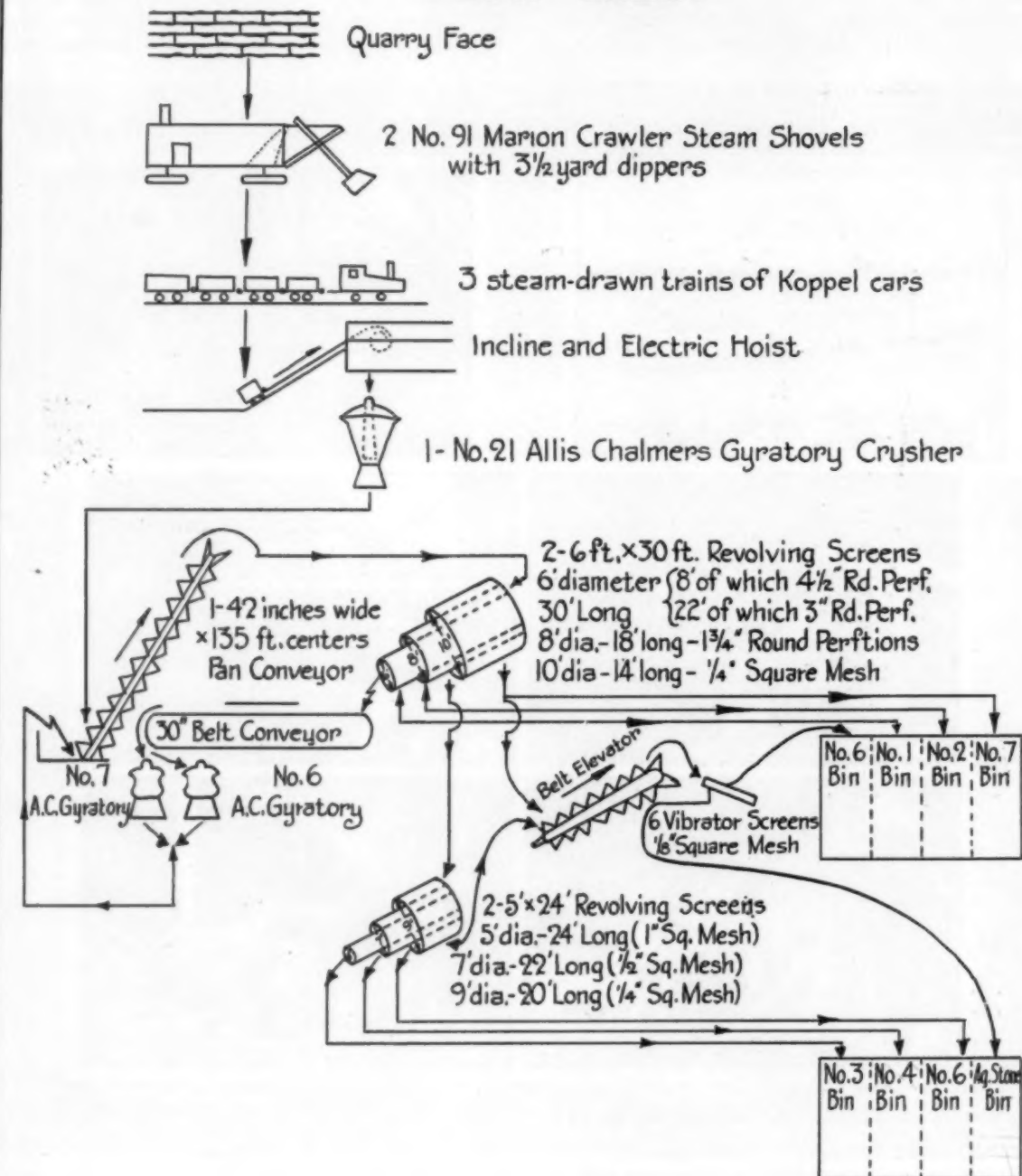
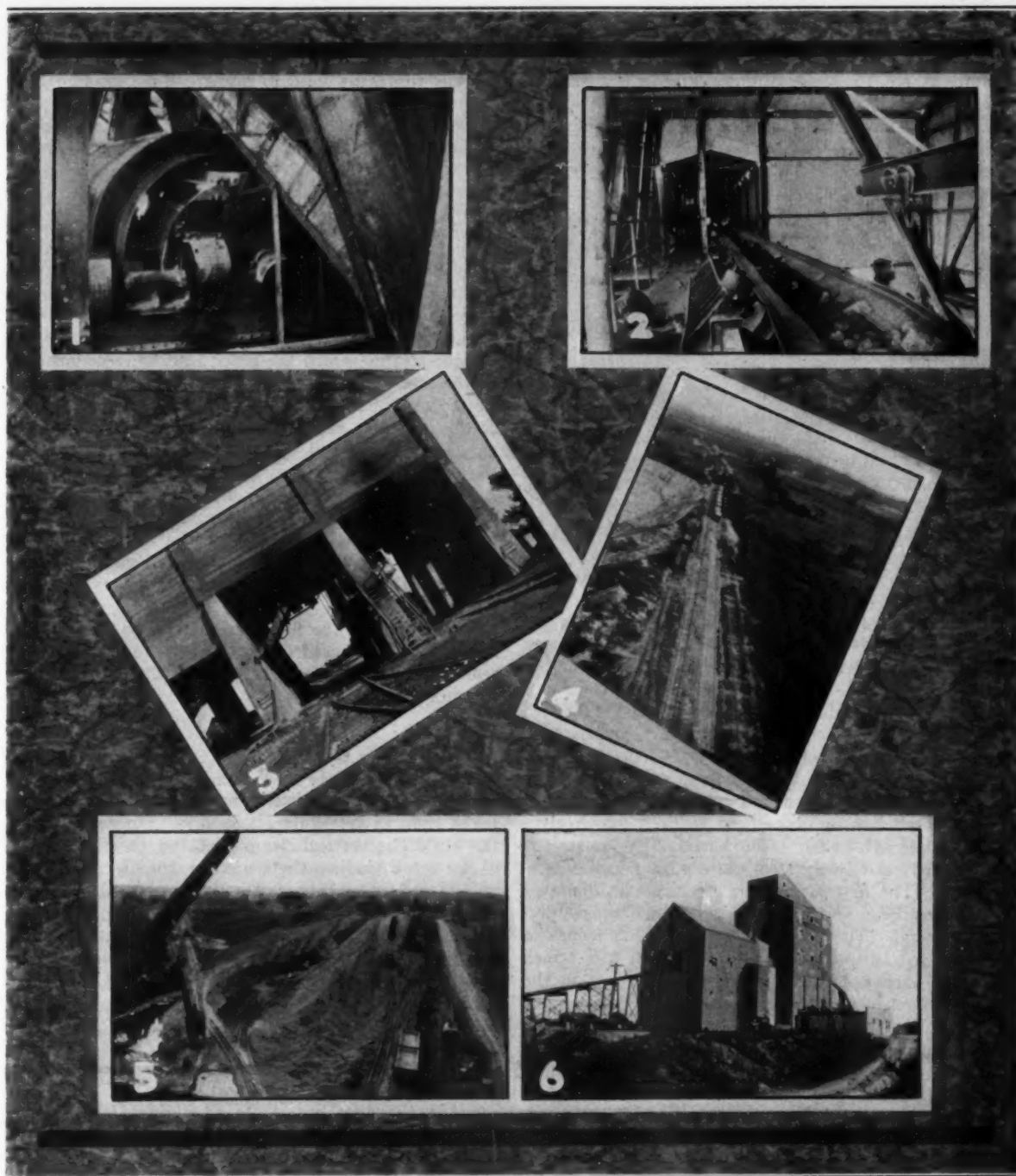


Diagram Showing the Flow of Materials from Quarry Face to Storage Bins at the Monroe Plant of the France Stone Co.



SCENES FROM A WELL-BUILT AND OPERATED CRUSHED STONE PLANT

1. Discharge end of revolving screen. 2. Conveyor returning over-size stone to the secondary crushers. 3. Bins for loading trucks and railway cars. 4. The loaded car storage. 5. The stone and empty car storage. 6. The office and plant

cline on the loads track.

An electric hoist is used to elevate the cars from the foot of the incline to the crusher floor and to hold them until they are dumped with a car dumping hoist. The cars are returned to the foot of the incline on the empties track.

A 225-horsepower slip ring motor drives the hoist through a Morse silent chain drive. The main drum shaft is extended on the open side through another

drum, which is used for a car dumping hoist.

After leaving the cars the stone passes through a No. 21 Allis-Chalmers gyratory crusher which is set to crush the stone to a maximum size of $4\frac{1}{2}$ inches, to minimize secondary crushing. It is possible to do this because the No. 21 has a much greater capacity at the normal setting than the rest of the mill.

The crusher is driven by a 200-horsepower variable speed motor, the power of which is transmitted through

Texrope drive. The variable speed motor is used to give a range of speeds to take care of the fluctuating load caused by the changes in stone structure, weather conditions, etc. It is especially desirable in wet weather, because in reducing the speed the entire mill capacity is reduced, which results in more efficient screening.

From the No. 21 crusher the stone drops into a pan conveyor 42 inches wide and 135 feet long, center to center, setting at a slope of 55 degrees 30 minutes, and traveling at a chain speed of 93 feet per minute. It is driven by a 100-horsepower motor and 100 AT Cleveland worm gear speed reducer.

From the pan conveyor the stone flows into two 72-inch x 30-inch open end revolving screens. Thirty-horsepower motors drive them through 500 AT Cleveland worm gear speed reducers, giving the screens a speed of 11 r.p.m. The screens are each composed of a barrel and two outside jackets. On the receiving end the barrel has 22 feet of steel plate with 3-inch round perforations, and on the discharge end 8 feet of steel plate with $4\frac{1}{2}$ -inch perforations. The first jacket is 18 feet long and 96 feet in diameter, and is made of steel plate with $1\frac{3}{4}$ -inch perforations. The outside jacket is 14 feet long and 120 feet in diameter, made of wire screen of $\frac{1}{4}$ -inch openings.

The stone passing over the 3-inch openings and through the $4\frac{1}{2}$ -inch openings is chuted to the No. 1 bin as a finished product. The stone retained on the $4\frac{1}{2}$ -inch screen is returned to the secondary crushers. That which passes through the 3-inch openings and is retained on the $1\frac{3}{4}$ -inch jacket, is chuted to the No. 2 bin as a finished product. The material passing through the $1\frac{3}{4}$ -inch jacket and retained on the $\frac{1}{4}$ -inch screen, is chuted to two 5-foot diameter x 24-foot long open end revolving screens. Each of these screens is driven by a power unit consisting of a 20-horsepower motor and a Farrell herring-bone speed reducer, which gives them a speed of 10 r.p.m. The barrels of these screens are covered entirely by steel plate with 1-inch square openings. The first jackets are 84 inches in diameter and 22 feet long, and are made of $\frac{1}{2}$ -inch square perforated metal. The outside jackets are 128 inches in diameter and 20 feet long, and are made of wire screen having $\frac{1}{8}$ -inch openings. The stone retained on the screen with 1-inch square opening flows through the chutes to the No. 3 bin, that passing the 1-inch screen and retained on the $\frac{1}{2}$ -inch, is chuted to the No. 4 bin, that which passes through the $\frac{1}{2}$ -inch openings, and is retained on the $\frac{1}{8}$ -inch, goes to the No. 6 bin. The chutes from all four screens to the bins are so arranged as to permit the mixing of any or all of the various sizes in the proper percentages.

Should there be an over-production of No. 1 and No. 2 stone the chutes are so arranged that these sizes can be returned along with the rejections on a 36-inch x 117-inch centers belt conveyor which moves at a speed of 250 feet per minute to the two secondary crushers, a No. 7½ McCully gyratory and a No. 8 Austin gyratory crusher. The No. 7½ McCully crusher is driven by a 40-horsepower motor and a Texrope drive. The No. 8 Austin crusher is driven by a 60-horsepower motor and a Texrope drive. Passing through these crushers the stone drops into the large pan conveyor and is again returned to the large screens.

Returning to the 30-foot revolving screens, the mate-

rial passing the $\frac{1}{4}$ -inch openings is collected in a hopper, from which it is elevated by means of a belt elevator with 24-inch buckets to a battery of six vibrator screens which are used to prepare stone grading from $\frac{3}{8}$ -inch to dust. Each one of these screens is separately driven so that any one of them could be shut down without interfering with the operation of the others.

WASHING

To further improve the cleanliness of the smaller sizes from $1\frac{3}{4}$ -inch to $\frac{1}{8}$ -inch, a washing system has been installed. Two centrifugal pumps of 1,000 gallons a minute capacity each, driven by 75-horsepower motors directly connected, pump the water through an 8-inch line to the screens. The flow is here divided into two 6-inch streams, which are piped into the receiving end of the screens. These pipes are 18 feet long, and are slotted so that the spray falls directly on the upper side of the stone bed in the screen. The water is in a large enough quantity and has sufficient pressure to reduce the percentage of the dust to less than $\frac{1}{2}$ of 1 per cent. After passing through the stone the water is caught in an electrically welded hopper from which it is flumed to a settling tank. To reclaim the small sizes of stone that float out in the water, an approved sand dewaterer is used. The material recovered here makes an excellent concrete sand.

Referring to the flow sheet it will be noticed that a Rotex screen is used to wash the $\frac{1}{4}$ - to $\frac{1}{8}$ -inch stone, which is the product that passes over the battern of the vibrator screen.

BINS

Railroad bins are built over two tracks, with 4 bins to each track. These have a capacity of 225 tons each. Each bin is provided with three 24-inch square gates set at right angles to the track so as to uniformly draw the bin. The vertical clearance below them is 21 feet.

For truck loading, there are six bins of 200 tons capacity each. One side of these is supported by an archway having a 27-foot span. This arch permits the trucks to enter from both ends at the same time and leave through the archway. Headroom under these bins is 14 feet. All the bins are made of reinforced concrete.

CONSTRUCTION OF SCREEN HOUSE

The screen house is built entirely of steel. All columns are H-sections. Girts and purlins are of channel sections, the floor beams are of standard I-beam sections, and the wind braces are of angle sections. The roofing and siding is Toncan corrugated iron.

The building is well lighted with Fenestra mill type windows. Four 14-foot square Kinnear roller-type doors are provided on the upper floors, and are to be used to bring repair parts into the mill.

The floors are of 3-inch assorted hardwood. The stairways are made of checker plate, and comply in construction with the state code. Railings for the stairways are of standard pipe construction.

Trolley beams have been placed over the screws and the headshaft of the pan conveyor to facilitate the handling of repair parts. Each trolley is equipped with a hand-gearred trolley car from which chain falls may be suspended.

CRUSHER BUILDING

Connecting the screen house to the crusher house is a walkway supported by the belt conveyor bridge and the self-supporting pan conveyor frame, which has a span of 60 feet. This building is built entirely of steel on concrete footings. In order to have maximum floor space on the crusher floor, A-frame type construction was used to support the roof. This eliminated the necessity of having central columns. The No. 21 crusher is set on a concrete base, and the No. 7½ McCully and No. 8 Austin are set on steel bases.

Above the No. 21 crusher is a 40-ton trolley beam, carrying trolley cars and chain falls to handle repair parts and an electric stone juggling hoist. The stone juggler is an interesting piece of equipment, having remote control. Its capacity is 10 tons.

MOTORS

Each piece of equipment is driven by an individual motor. All motors are of the enclosed pipe-ventilated roller-bearing type. There is a fan built in each, which draws clean air from the outside and blows it through the motor, keeping it cool. They are absolutely dust proof, which eliminates rotor trouble. The motor controls are so interlocked as to start the machinery in proper sequence.

STARTING SEQUENCE

1. Water Pumps.
2. Vibrator Screens.
3. Belt Elevator.
4. Belt Conveyor.
5. 60-in. x 24-ft. Revolving Screens.
6. 72-in. x 30-ft. Revolving Screens.
7. Pan Conveyor.
8. Secondary Crushers.
9. Primary Crusher.

The control is so arranged that when starting in sequence each motor attains full speed before the following one starts. This arrangement minimizes the peak load, which results in lower power cost than if all were started at once, because power at this plant is purchased on a demand charge basis.

The controls have also been arranged so that during repair work any equipment may be run by itself.

All electrical equipment is protected by overload relays. Totally enclosed starting boxes with push button control are used.

LIGHTING

The entire mill, storage tracks, incline and quarry are electrically lighted to facilitate night operation. Flood lights are used at dangerous places.

OFFICE

The office is a one-story stucco fireproof building. The floor plan is arranged so as to provide a large room for the clerks, an office for the superintendent, a conference room, a store room and a lavatory. It is well lighted, and heated by an Arcola hot water system.

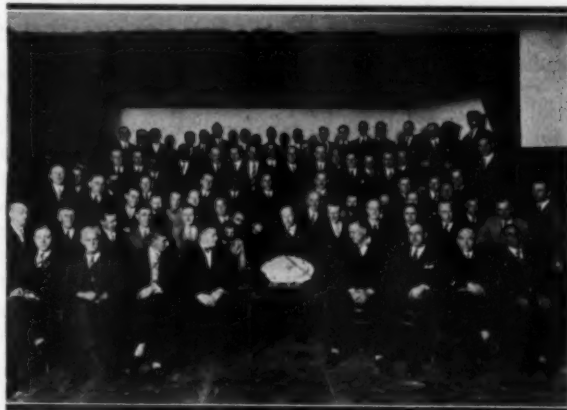
GENERAL DISCUSSION

The reader has undoubtedly noticed that everything was designed to make working conditions safe and comfortable for the men. The wooden floors were used in preference to steel, because they are easier to walk on and add to the millmen's comfort in cold weather.

Railings were provided around all openings and stairways, and all parts of the mill are well lighted and ven-

tilated by windows.

Because of the rigid safety first rule practiced by the company, there was not one serious accident during the construction of this mill.



Preparing to Cut the Birthday Cake at a Recent Shop Meeting of Frank N. Goble, Inc., Employees

Employees Present Contractor with Birthday Cake

AS added evidence of the fine spirit of the organization of Frank N. Goble, Inc., White Plains, N. Y., at the April shop meeting which was addressed by Frank H. Alcott, structural engineer of the National Lumber Manufacturers' Association, on the subject "Improved Practice in Lumber Use," a huge birthday cake artistically decorated and illuminated with candles was presented to William J. Gobel, President of the company. (A photograph of the assembled company and the cake being cut by Mr. Goble with cavalry sabre is reproduced here.)

At this meeting, announcement was made that the month of March showed a 100-per cent safety record, there being not a day lost by any employee due to accident and with a working total of 21,100 hours. The company is making a determined effort to retain the William F. Tubising silver cup of the Associated General Contractors won last year. This cup must be won for two successive years to retain permanent possession. To this end constant inspection of jobs is maintained to spot and eliminate hazards, and the gospel of "Safety First" is kept before the men in various ways.



A Foote 27-E Paver, Owned by Ducey & Breitenstein, Pasadena, Calif., Ready to Pave a Strip in Front of the New Pasadena City Hall. This Paver was Sold by the Contractors Equipment Co., Los Angeles, Calif.

Canal Converted to a Parkway

By Joseph Cohan

Construction Manager, The Holmes Construction Co., Wooster, Ohio



O more will Cincinnati be able to go "Over The Rhine" because The Rhine, as the old canal was popularly referred to, is gone. In its place, Cincinnati has a boulevard approximately seventy-two feet wide. It is the intention of this article to show the different construction methods used in building the Boulevard,

now known as Central Parkway.

On July 16, 1926, The Board of Rapid Transit Commissioners let a contract for the Improvement of Central Parkway from Broadway to Brighton. This contract was awarded to The General Asphalt Paving Co. of Canton, Ohio, which, in turn, sublet all of the ground and concrete work to The Holmes Construction Co. of Wooster, Ohio.

The project is about 10,500 feet long, and follows the old Miami and Erie Canal through its entirety. Under a previous contract, a set of 14- x 16-foot twin tubes was built and the remainder of the canal filled with sand and gravel. The major items of this project were as follows: 52,700 cubic yards of grading; 19,000 feet of sewers ranging from 12 to 27 inches; 20,000 cubic yards of concrete base; about 2,500 cubic yards of concrete in retaining walls and structures; 81,100 square yards of asphalt paving; 8,000 square yards concrete paving; 9,000 square yards brick paving, and 310,000 square feet sidewalk. In addition, there was approximately \$40,-

000.00 worth of water lines and appurtenances, and about 50,000 lineal feet of electrical conduit.

Figure 1 shows the cross section of the Boulevard from Broadway to Liberty Street, which is about a mile in length. Figure 2 shows the cross section of the Boulevard from Liberty Street to Brighton, the length of



A Section of the 10,000 feet of 4-foot Curb Walls Showing Steel Forms

which is approximately a mile. A slight change was made in the construction of the curb and gutter on Section No. 2, and instead of the separate concrete curb, an integral curb and gutter was built as shown on Figure 3.



Completed Section of Curb Wall with Ventilator Gratings Shown in Central Parkway

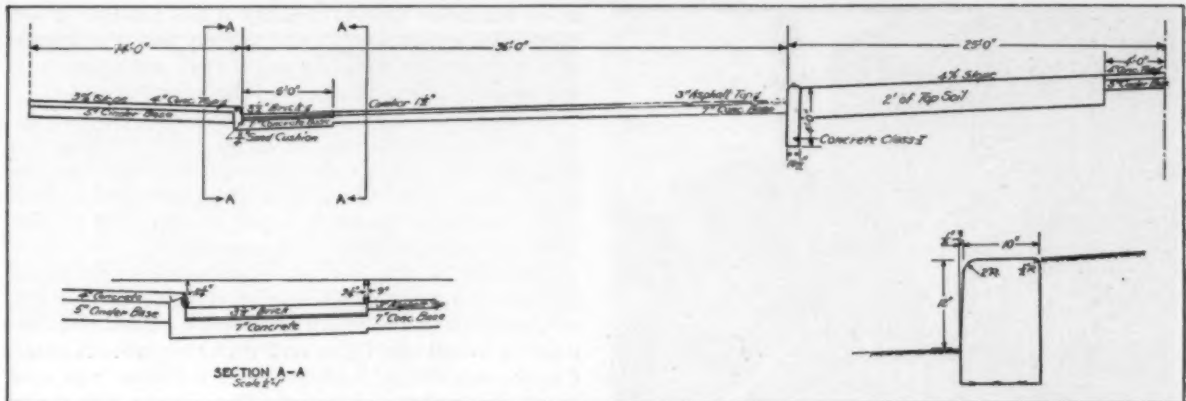


Figure 1—Typical Boulevard Section from Twelfth Street to Liberty Street

SEWERS

In September 1926, the sewer gang was started on the Broadway end of the project. This being one of the oldest parts of the city, we encountered considerable obstructions, which were not on record anywhere, and necessitated considerable changes, slowing up our progress very much. A Keystone excavator and an Austin backfiller were used by this gang and were supplemented by a hand gang for digging the shallower inlet connections. Ninety per cent of the sewer trench had to be tight-sheeted on account of the sandy condition of the soil and the proximity of buildings. As we did not expect to have so much sheeting, we used the old-fashioned method of hand-driving the sheeting for about ten per cent of the length of the job, after which we used an Ingersoll-Rand pile driver head attached to a pneumatic hammer to drive our sheeting. This speeded up our output very considerably.

WATER LINES AND APPURTENANCES

Water lines and appurtenances were constructed by The Crumley, Jones and Crumley Co. of Cincinnati, Ohio. Hand methods were used entirely because of the number of obstructions that were met.

EXCAVATION

There were about 53,000 cubic yards of excavation, of which 25,000 cubic yards had to be wasted. The excavation was done with the aid of a Lorain 75, 1¼-yard gasoline-driven shovel. Trucks of 2- and 4-yard sizes were used to haul the waste soil to a city dump about a mile away from the job. Considerable difficulty was encountered in removing the concrete in the intersecting streets, but no blasting was necessary and all the work was done with the power shovel, aided in places by pneumatic drills.

CONCRETE

Practically all of the concrete work was constructed by the following methods: coarse and fine aggregate, which was composed of river gravel and sand, taken from the Ohio River, was delivered to the plant of The T. J. Hall Co. There, a set of Blaw-Knox weighing batchers was installed into trucks. These pneumatic-tired trucks carried two batchers. Nearby, a cement shed was erected and the truck, in passing, stopped long enough to get its proper amount of cement. This aggregate and cement was then brought up to the street, where it was mixed by a 27-E Rex paver.

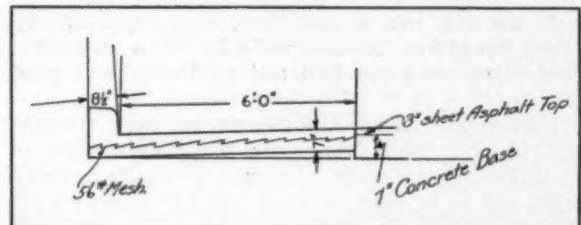


Figure 3—Altered Curb and Gutter Section Indicated in Fig. 2

The retaining walls were constructed by making up standard wood forms and the concrete deposited with the aid of a crawler crane, which also helped in doing the excavating and moving the forms.

A reinforced concrete wall about 500 feet long and ranging from 1 to 22 feet in height was built as part of the contract. This wall was set on piers instead of the ordinary footers. A chemical composition was used on the forms to give the face of the wall a granular appearance. This, however, did not prove entirely satisfactory.

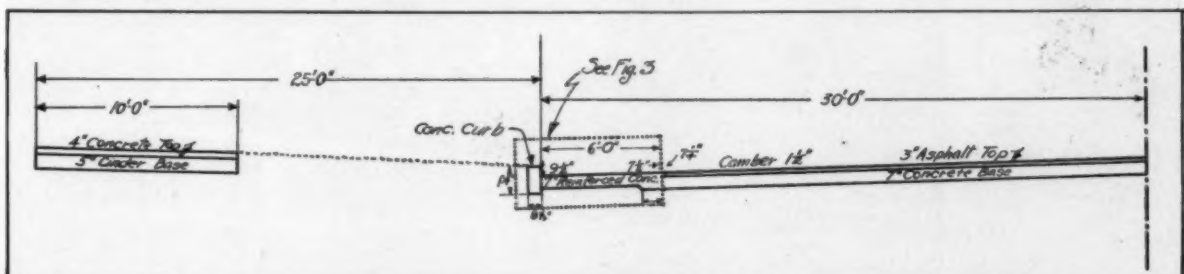


Figure 2—Showing a Typical Section of the Boulevard from Liberty Street to Mohawk Place



Pneumatic Hammer with Pile Driver Head Used to Drive Wood Sheet Piling

In the first two sections there were approximately 10,000 feet of four foot curb walls, for which Blaw-Knox steel forms were provided and used with very good success.

Considerable change in grade was necessary throughout the job as the buildings were originally designed to meet the old canal grade. A number of small temporary walls had to be built to retain the fill caused by the change.

The pavement was laid in the standard manner, a screed being used to get the proper crown, while in other places wooden stakes were driven and left in during the concreting operations.

There was an unusually large area of sidewalks for a project of this kind. The sidewalks were laid in the same manner as the pavement, and while the concrete

paver was never used to capacity it was possible to lay from 3,000 square feet to 4,000 square feet of sidewalk with a reasonably small crew. A steel protection curb was installed as shown in one of the diagrams.

An ornamental foot bridge was constructed over Central Parkway at Baymiller street, well towards the Brighton end of the job. Roos-Shors, made by The H. W. Roos Co. of Cincinnati, Ohio, were used instead of the standard way of building falsework. The crawler crane was used to deposit the concrete.

Conduits for the electric lighting and traffic signal systems were built by The Union Gas and Electric Co. of Cincinnati, Ohio, which later was awarded the contract to install the lights and traffic signals. A small ditching machine, a Buckeye traction ditcher, was used to do the trench excavation. The granite and durax work was done by The August J. Henkel Construction Co., which used standard methods for this type of construction.

About 15,000 cubic yards of soil were furnished by the city and placed by the contractor in the planting space through the center of the first two sections. The Park Department of the city has already planted considerable shrubbery, which adds quite a bit to the beauty of the street.

BUILDING THE APPROACHES

Considerable difficulty was experienced in building the approaches to the Boulevard on some of the intersecting streets. This was due to the difference in grade, which was as high as 7 feet, and the necessity of maintaining traffic during construction. On Sycamore Street, where there was an existing bridge, the street had to be built while maintaining street car traffic over one-half of the bridge. In order to accomplish that, the bridge was burned off through the center, temporary supports were put in, a temporary wooden retaining wall was constructed so that it would hold the fill, and then one-half of the intersection completed. When one side was paved, the street cars were diverted to the completed side and the same procedure was followed on the remaining half. Quick setting cement was used to expedite the opening of this rather important intersection.

GUTTER AND PAVING

A 6-foot brick gutter, as shown on the cross section, was built on the first and part of the second sections.



The Retaining Wall after the Removal of the Standard Wood Forms



Building a Foot Bridge Over Central Parkway Using Roofores Instead of Usual Falsework

The remainder of the gutter was built of concrete reinforced with steel fabric.

The sheet asphalt pavement, which consisted of 1½ inches of binder course and 1½-inch top course was placed by The General Asphalt Paving Co. In order to get greater compression, a 3-wheeled, 10-ton roller was used instead of the customary 8-ton tandem roller.

This project was completed November 1, 1927, and it was built under the direction of Frank L. Raschig, Chief Engineer of The Rapid Transit Commission, and H. C. Kleemeier, the Resident Engineer. The writer was in charge of the construction, having as his assistant G. H. Oxenrider.

Carelessness and Its Tolls

By C. G. Chipchase

Mechanical Engineer, Division of Industrial Accidents and Safety, San Francisco, Calif.

NO matter how small, all accidents are costly. It is often difficult to determine accurately and to appreciate fully, the loss in time and money. It is safe to say, however, that in many cases the indirect cost of accidents to the employer is 200 per cent greater than the cost of medical bills and compensation paid by the insurance companies. But this is only one of the tolls taken by accidents from carelessness.

There is the injured employee, who may suffer untold agony or even death. In the first case he will receive compensation, to be sure, but not until after he has been out of employment seven days and at a rate probably far below his daily income. When he returns to work, he must take a job less strenuous and in many cases not so well paid. In the second place, if the injury proves fatal, his family will be paid the death price and burial expenses, but are left alone to fight their way without a father or bread winner.

Another fact, brought out as we study the results of accidents, is that others in an organization may be affected by an accident to an employee, which brings us to the point that all should have at least a selfish interest in the prevention of accidents. Regardless of the position held with your concern, by the very nature of that connection you must accept the basic fact that your best interests are served and advanced through the organization which employs you. If your interests are to advance, it will be through the advancement of the interests of the company. Irrespective of personal opinions that persons may have regarding the merits of accident prevention, individual personal interests are surely bound up with the problem. Failing to give your hearty cooperation to the utmost advancement of accident prevention simply means that you are neglecting an opportunity to further your own success.

Carelessness on the part of some one in charge of the job was responsible for this example of industrial accidents. During the erection of a garage and service station, it was neces-

sary to place a 24-inch by 30-foot I-beam on the top of two brick pillars, together with other wooden trusses from the main building wall to the I-beam. The rig used to place the beam was a derrick mounted on the bed of an auto truck and provided with a small double-drum hoist, deriving its power from the truck engine through a power take-off.

The beam was placed on the column on its lower flange, which is not over four inches wide. The truck driver was then instructed to back out into the street and drop the boom down so that he could come forward again and then to raise the boom in back of the beam for the purpose of picking up a wooden truss to be mounted on the beam and opposite wall. This should not have been done, for the slightest jar would upset the I-beam, as it was not in any way secured to the columns.

The driver reached in and under the I-beam to pick up a truss that weighed about 6000 pounds. To gain the few inches of extra height necessary, orders were given to raise the boom angle closer to the perpendicular. The operator tried to do this, but due to the small construction of the hoist friction and a possible improper control combined with a lack of good hoisting engineer experience, the boom came up three feet, causing the truss to swing, knocking down the I-beam. The I-beam, in falling, hit the operator, fracturing his skull and breaking several ribs which punctured his lungs. Death resulted the next day. Had it not been that the heavy angle iron struts, that supported the mast of the derrick, caught the falling beam, the operator would have been crushed beyond recognition. Another workman suffered a fractured foot and other internal injuries.

This accident from carelessness affects the employment department of two separate contractors on the job, the steel man and the erecting man. The Insurance Department of the State was affected, because an accident increases compensation costs. The job was affected through interruption, which lasted for several hours and involved at least ten or more employees. The Sales Department was affected because accident costs must be absorbed as a production cost, which in turn increases the cost of the product. This gives competitors the advantage and increases sales resistance and expense. The progress of work in the shop and shipment of other orders are also affected, being retarded to the extent of causing discontent from customers in not receiving their shipments on time. The Industrial Relations Department was affected, because an accident has a demoralizing influence among a working force and reduces morale.

All these factors work to reduce the prosperity of the organization. The company is less able to pay increases in wages or make promotions to its employees and provide a reasonable return. Therefore, it is apparent that accident prevention, to be of the most benefit to any concern, must be a complete co-operative proposition. All are benefited by accident reduction and all suffer from accident occurrence.

ACKNOWLEDGMENT.—From an article in *California Safety News*.

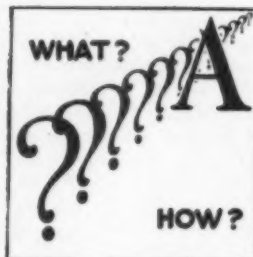


A Bad Crash in California. I-beam Annihilates Driver's Cab and Steering Gear on Heavy-duty Truck

A Contractor's Problems as Seen by Himself

By H. T. Routly

Routly Construction Co., Toronto, Ontario



CONTRACTOR might go on almost indefinitely stating his problems. To state them is one thing, to solve them another. Definite and permanent solutions are impossible. The best solution for one contract may be entirely wrong for the next. Some are susceptible of more than one solution, depending largely on

the experience and judgment of the individual. The problems of the highway contractor are like the air he breathes or the food he consumes. They are so continuously a part of his daily routine as to approach the danger line where "familiarity breeds contempt." The young contractor must treat them all with the greatest respect or one of them will wreck him ere he is well under way, and the older contractor may never dismiss any one of them unconsidered, though his past experience will enable him to more quickly discern the bearing of each on any new contract. They are the so-called practical problems, and in constantly dealing with them each contractor develops the technique which stamps the quality of his work and assures the success of his business.

A FEW OF THE PROBLEMS

1. *On securing work:* How shall a contractor secure work? Shall he bid on a good margin on a lot of contracts, hoping to land one at such good profit as to make up for all the expense of tendering on the others? Or shall he pick out one he thinks he can execute cheaper than all other contractors and bid to get it?

2. *On organizing work:* Shall he subcontract his requirements from other contractors or shall he bid the contracts and sublet portions to others, or shall he always play a lone hand?

3. *A few plant problems:* Shall he purchase and own all his plant, anchoring himself indefinitely to highway contracting, or shall he purchase only such portions as he cannot rent and be ready to quit the game at any time? Shall he specialize on only one type of plant or shall he try different makes, and after a while standardize on what his personal experience indicates as best suited to his requirements? What spare parts shall he carry in stock? A full line will tie up a lot of money, some of it perhaps for years, but on the skill with which he chooses that list will largely depend the success of his operations. Shall he buy the best machines at high initial cost or be content with cheaper second-choice and face large annual costs for breaks and replacements? How about trucks? Shall he own his trucks or shall he rent by the day or by the ton-mile?

4. *A few quarry queries:* Shall he choose the easier quarry with a long haul or the more difficult quarry

centrally located? Shall he operate by air or steam; hoist his rock by derrick, incline, cart or trucks; use steam shovels or hand labor? Shall he use jaw or gyratory crushers; rotary or vibrating screens; side or bottom loading bins, etc.?

5. *Financing his work:* No one below the millionaire class can possibly undertake large highway contracts, purchase a plant outright and meet payrolls and other bills on the dot. Shall he then secure a moneyed partner? Or shall he plug along taking only such work as is well within his means and plan to grow safely though slowly by leaving his entire profits in the business from year to year, or shall he stretch his bank credit to the limit, purchase plant and supplies on the longest terms, undertake the larger contracts and then grow quick or go quick? The strain of financing highway contracts has broken the nerve and health of many a man on whom the difficulties of construction have failed to make any impression whatever.

To the end of this—the age of highways—the lure and challenge of these very problems will continue to attract trained and competent men and perhaps also the annual crop of butchers and bakers, doctors and undertakers, but as civilization has progressed beyond this indiscriminating stage in so many other lines, we hope that it will also make progress in the method of choosing its highway contractors.

RELATIONS BETWEEN CONTRACTOR AND ENGINEER

There is also the problem involving the relation between the principal, the engineer and the contractor. By "the principal" in highway work, we mean those representatives chosen or elected by the public from the Federal chief engineer down to the township roads committee. By engineer, we mean those officials employed first to give expert technical advice and later to supervise the actual construction of our highways.

The first problem which confronts the principal, the engineer and the contractor is the basic necessity of justifying public confidence in highway programs. One of the main elements on which this confidence is founded must be that money is expended in the most efficient and economical manner. The ideal of greatest economy and maximum results is possible only where each of the three, the principal, the engineer and the contractor, is thoroughly qualified to contribute his quota and where a proper spirit of harmony and co-operation exists between them. The economy and quality falls and the cost increases when any one of the three is incompetent or when any one of them throws the monkey wrench of discord into the combination. The failure or refusal to cooperate or to justify cooperation is unpatriotic and disloyal and results ultimately in placing an unnecessary burden on the taxpaying public, —though it generally comes first of all on the con-

tractor involved and constitutes one of his most serious problems.

RELATIONS BETWEEN CONTRACTOR AND PRINCIPAL

In what manner does the principal form one of the problems of the contractor? It is the duty of principals to study the needs of their constituents and is their responsibility to prepare the program. One of the ways in which the principal often fails to contribute his quota toward ultimate economy and one of the ways in which he becomes a real problem to the contractor is in his failure to outline a comprehensive program so that the contractor can gage what may be expected from him and his associates during a period of years. Also in the time and manner in which the principal brings on his work may much be lost or gained in the final cost. A serious problem has arisen for many a contractor in the past when the principal has awarded contracts in excess of the funds provided. Much money could be saved by the adoption of better methods of letting highway work. If each season's program could be outlined the previous summer and most of the contracts awarded in the autumn, contractors could bid lower, use winter months to advantage, organize better, execute quicker, cause less annoyance to the traveling public and make more consistent profits. This is one problem of the contractor which the principal alone can solve, but from the nature of our governing institutions, he is often unable to put his solutions into practice. Insofar, however, as the principal can systematize his program by early announcements of his future work and by autumn lettings in contracts of sufficient magnitude to permit the installation of the most economical plant and by stabilizing his annual program, so that competent contractors are reasonably sure of employment from year to year—in these and many other ways, can the principal help to solve the great problem of uncertainty for the contractor to the ultimate benefit of the public he represents.

THE POSITION OF THE ENGINEER

Now the biggest of all the contractor's problems is the engineer and, conversely, the biggest problem of the engineer is perhaps the contractor. Some members in each class fail to recognize that these two are jointly and severally responsible to the principal and to the public they represent for a careful, economical and proper expenditure of the money involved. They are essentially co-workers, almost partners, and only when they work in a spirit of harmony and mutual helpfulness can the desired end be obtained at the least expense of time and money. If either adopts a spirit of discord or seeks to hamper, embarrass or interfere with the other, he is untrue to the best ethics of his profession and disloyal to the interests of his principal and

with the best intentions, no doubt, but from a wrong mental attitude, the engineer is frequently responsible when friction exists.

To begin with he often initiates a lot of avoidable trouble (1) by unreliable or ambiguous data or lack of essential data in his information to bidders; (2) by the one-sided nature of the contract—for which he is not always to blame; (3) by the unduly exacting clauses in his specifications; (4) by his assumption of superior wisdom and absolute authority while completely shirking responsibility for results; (5) by his attitude of mind whereby he treats the contractor from the beginning as a crook and a cheat and ends by practically forcing him to become one to save himself alive. As the contracting and engineering professions each come to a better understanding of the other's difficulties, the other's aims and the other's qualifications, and come more and more to realize that the best results are gained by cooperation rather than by coercion, the benefiting public will readily indorse the higher estimate each places on the other and readily approve the removal of the age-old barricade of mutual distrust.

THE INCOMPETENT CONTRACTOR

Finally, the problem of paramount importance probably is "to be or not to be a highway contractor," and this involves the problem of the incompetent contractor. Fully 80 per cent make the mistake of their lives when they attempt to solve this problem. It is an economic tragedy that scores, yes hundreds, of men plunge into an occupation for which they are unqualified by nature and experience to make a success. In making the fatal error,

Construction Axioms

1. *The most capable engineer cannot secure a first class job from an incompetent contractor.*
2. *A competent contractor may do a good job in spite of a poor engineer, but he can do a better job a lot easier for a good engineer.*
3. *Of all those associated in the execution of a highway contract, the contractor is the most vitally concerned in delivering a satisfactory job. Prompt settlements and repeat orders are essential to his continuance in business. He has his family inheritance and past profits, his present hopes and his future prospects all at stake.*

they drag their families and dependents through years of hardship and disappointment, only to end in disaster; and while the unfortunate contractor has been making a mess of his own affairs and has caused grievous loss to those legitimately in the business, he has very often been making a bungle of the public contracts he has undertaken. It is not claimed that all the men who tried to make a success of highway contracting and failed have made a bungle of the work they left behind or that the public did not receive more than it paid for in some cases. Far from it. Many a man has put the last dollar and the last shred of nerve and the last ounce of energy into fighting vainly to fulfill his contract, a practical impossibility well recognized from the first by his more experienced competitors, an impossible situation which the principal as representing the people and the engineer as his expert adviser should have also recognized and taken effective measures to forestall. This would save the benighted individual and his family and his creditors from the dire results of his own lack of judgment. That alone would justify our highway authorities in taking some measures toward the prevention of so much wreckage. Our officials are

not permitted to condone or encourage personal suicide, neither should they be excused if they deliberately encourage or permit a man to commit financial suicide, often involving disastrous consequences to many outside his own family circle. Some definite attempt should be made to prevent these useless disasters.

In professional life, only certified men and women are permitted to serve the public in law, medicine, education, nursing, dentistry or theology. None but certified men may do its electrical work or its plumbing. Certificates of qualification are required to provide milk, meat, drink and entertainment. The surveyors and engineers who design and supervise highway and other construction must pass exacting tests and secure certificates of qualification. Even the truck drivers and engine runners on highway contracts must bear certificates of competence. But the one individual on whom more than any one else depends the economy and the safety of the structure generally requires one lone qualification—that he be a low bidder.

The problem of the incompetent contractor, of course, far transcends the mere question of low bidder, though that is the usual mode of entry. I can offer no complete solution for this problem but would venture to suggest that all public contractors should have to pass a strict investigation of their experience, business character, financial standing and other qualifications by some fully constituted board who would issue certificates of the amount and class of work each applicant was deemed competent to undertake and without which no tender might legally be received by any public officer.

ACKNOWLEDGMENT: From a paper read before the Fourteenth Annual Convention of the Canadian Good Roads Association.

An Unusual Creosoted Timber Bridge

THE construction of a bridge across Bayou Lacassinne between Lake Charles and Lake Arthur in Jefferson Davis Parish, Louisiana, is a practical demonstration of the graceful and artistic effect possible through the use of treated timber.

In the design of the drainage structure it was necessary to allow for an open channel for the passage of light draft boats and for floating drift such as is always borne downstream in

time of flood.

In order to obtain the vertical clearance required by the U. S. War Department for navigable bodies of water, it was necessary to elevate the span proper to a height of 25 feet above high water. As the general elevation of the ground surface of this location is only slightly above average low water level, the approaches to the span had to be built on a rising grade. Instead of adopting the usual method, a flat gradual raising of grade from the ground elevation to the fixed span level, the design of these approaches specified the construction of a bridge floor of varying elevation in the form of a parabolic curve.

The length of the bridge is 724 feet and it consists of a 70-foot steel center span and two creosoted southern pine timber approaches, each 327 feet in length.

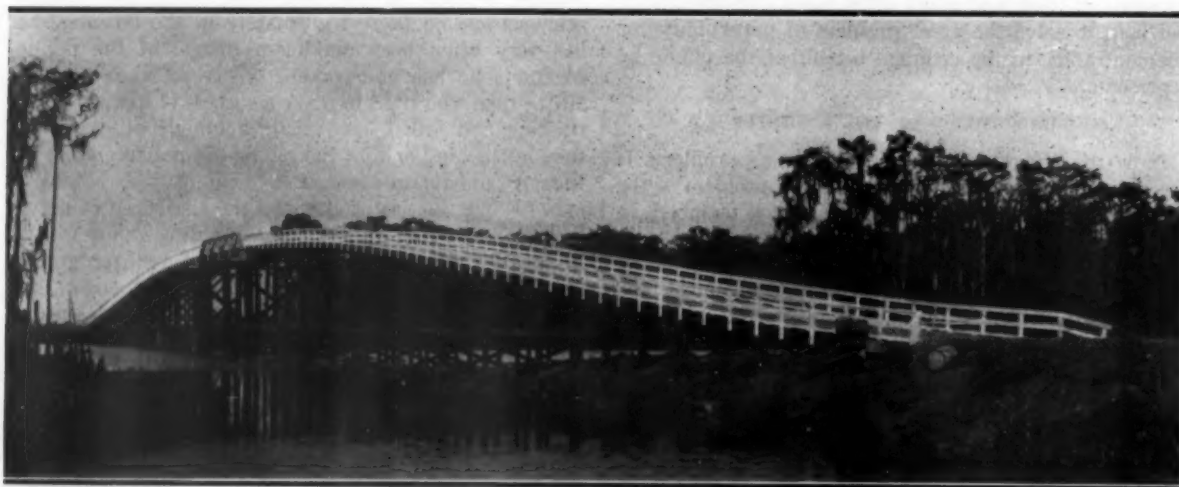
The center span is supported on two pier foundations, each consisting of ten creosoted southern pine piles driven in two parallel, 5-pile bents, 2 feet apart. Thus the piles are grouped in pairs and are firmly held in place by a double system of bracing with 3 x 10-inch planks. Aside from this bracing, six lines of horizontal braces extend from low water elevation to a point 6 feet above low water level. These piles are first cross-capped with 10 x 12-inch x 3-foot timbers upon which is placed a grillage of 10 x 12-inch x 25-foot timbers. Then two caps, 12 x 12 inches x 22 feet, are applied, one upon the other to form a foundation for the stringers of the timber approaches. The center span rests directly upon the grillage timbers.

The approaches are constructed in accordance with the standards of the Louisiana State Highway Commission. They are similar in design as in length, each consisting of thirteen 25-foot spans supported on 4-pile bents. The size of the caps is 10 x 12 inches x 22 feet, stringers 6 x 16 inches x 26 feet, flooring 3 x 10 inches. Eleven lines of stringers are used.

Construction of this bridge required approximately 82,600 board feet of creosoted timber and 7,000 linear feet of creosoted piling. Timber and piling were treated under pressure with a final retention of 12 pounds of creosote per cubic foot in accordance with the treating standards of the Louisiana State Highway Commission, which is equivalent to American Wood Preservers Association standards. Rails, posts and hand rails were not treated and were painted with white lead.

This project clearly demonstrates the economy of a treated timber bridge. The waterway had to be kept open for navigation and had a low level bridge been constructed, a draw span would have been required with its accompanying expense of a bridge tender.

This bridge, which is known as State Project No. 512, was designed and constructed under the supervision of N. E. Lant, Bridge Engineer of the Louisiana State Highway Department. The contractor was J. A. Hanchey of Mittie, La.

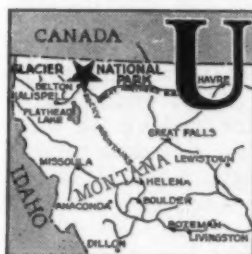


The Lacassinne Bridge Built on a Parabolic Vertical Curve with Creosoted Timber

Transmountain Highway Construction in Glacier National Park

By W. G. Peters

Associate Highway Engineer, U. S. Bureau of Public Roads, Portland, Ore.



UNTIL recent years the exploitation of Glacier National Park by the construction of modern highways was given very little consideration. The extremely rugged and mountainous nature of the park, which made it a place more for saddle horses or hikers than for automobile traffic, undoubtedly accounts for this

delay in highway building. In 1924, co-operation between the United States Bureau of Public Roads and the National Park Service was entered into for the purpose of making surveys and supervising the highway construction, such work to be done by the former government division. The Transmountain Highway in Glacier Park was the first work undertaken under this co-operative agreement.

Late in the fall of 1924, the field work of the survey was completed. Early the following year plans had been made and specifications written to cover the first section to be placed under contract, known as the West Side Project. The field location and preliminary plans and specifications were made under the direction and supervision of F. A. Kittredge, Highway Engineer of the Bureau of Public Roads and now Chief Engineer for the Park Service.

This project begins at a point on McDonald Creek 20½ miles north of Belton, Montana, the western entrance to the park, where are located the administrative headquarters of the park service. The route of the section being built follows up McDonald Creek for a distance of about 2½ miles before beginning the climb along the "Garden Wall" to Logan Pass, the divide in the Rocky Mountains terminating this section of the highway. The length of the project is 12.4 miles and goes from elevation 3537 at the beginning to 6650 at the Continental Divide on Logan Pass. The maximum grade was fixed at 6 per cent compensated on curves, the maximum of which was 56 degrees.

CONTRACTORS INSPECT PROJECT

The work being of large magnitude and of unusual nature in many respects, it was decided that the best and most satisfactory way to show the projected improvement to the interested contractors was to have such men meet in a body with the Bureau of Public Roads engineers and Park Officials at the site of the work prior to submitting of bids. In this way many of the special items and requirements mentioned in the specifications and plans could be explained on the ground. Consequently this procedure, though hardly customary, was followed, and from June 2 to 5 about thirty-five contractors looked over the work. For

those so desiring, saddle horses were secured for travel over the steep mountain trails along the route. Meals and bedding were supplied the contractors by the combined engineering and park forces at the Resident Engineer's camp at Trapper Creek near the beginning of the project. Without a doubt the contractors who met there will recall the accommodations and services with mingled sensations. A drenching rain during the period of inspection did not add to the comforts provided.

The principal items of work were given as follows:

Clearing	90 acres
Excavation, unclassified	480,000 cubic yards
Tunnels (including half tunnels)	16,000 "
Structures, masonry	2,200 "
Masonry Rails, Walls, etc.	7,000 "
Surfacing	14,500 "

Alternate bids were asked for on the use of either power shovels for excavation or excavation by hand methods.

CONTRACT AWARDED

On the opening of bids on June 10, 1925, the twelve submitted were found to range from \$1,339,200.00 to \$869,145.00, the latter being that of Williams and Douglas, general contractors of Tacoma, Wash., to whom the contract was awarded on June 11, 1925. This bid was on a basis of the use of power shovels in excavating and corrugated metal culverts.



Location of Transmountain Highway in Glacier National Park

The clearing was fairly heavy and consisted of fir, spruce, tamarack and birch with considerable underbrush. The clearing of the upper two miles was comparatively light, being near the timber line.

The excavation was largely solid rock of limestone composition and as a general rule full of seams and crevices, breaking in large pieces after shooting.

Cement rubble masonry retaining walls, guard rails and culverts were planned in order that the materials at hand might be used and effects obtained that would at the same time harmonize with the general landscape.

The surfacing specified was to be of crushed rock or gravel, the base being $1\frac{1}{2}$ inches in size and the top course $\frac{3}{4}$ inch size, finished to a width of 16 feet.

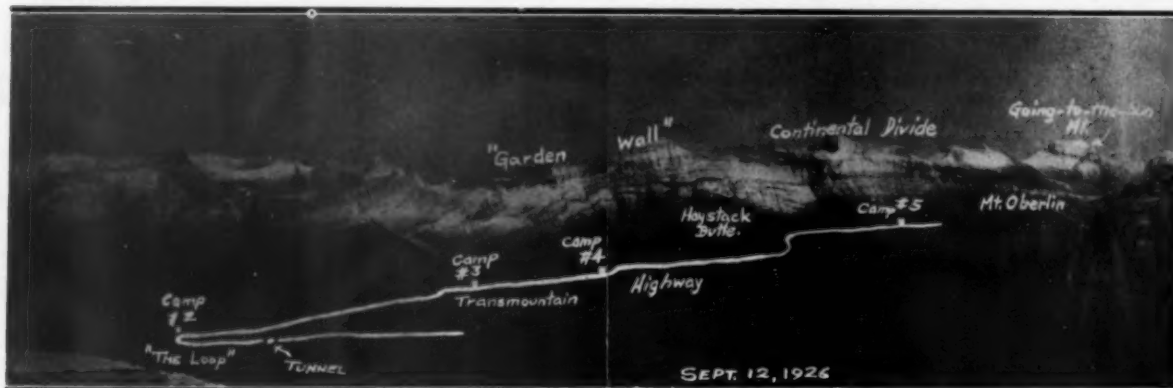
SUPPLIES

Within two weeks after the contract was awarded, the contractors were on the job beginning the preliminary work of construction. Headquarters were established at Trapper Creek at Station 580, 11 miles from

as well as to floor and wall up the sleeping quarters tents for the laborers, $\frac{3}{4}$ -inch lumber was resawed to $\frac{3}{8}$ -inch size. This doubled the surface measure of the lumber with even a slight reduction in the total weight for the horses to pack. The camp carpenter at headquarters cut the lumber in desired lengths suitable for packing and for assembling later. The result was that very good living accommodations were established at all camps from the bottom to the summit of the job.

EXCAVATION

Excavation of the road during the first year was carried on from the end, Station 657, to Station 500, a $\frac{3}{4}$ -yard Osgood gas shovel being used for the work. While this work was going on the rock cliffs between Stations 380 and 400 were being attacked. Here two single-hammer Sullivan portable compressors were used to supply the air for the two Waugh clipper drills. These cliffs, being several hundred feet in height and nearly vertical, could only be passed after a road had



Panoramic View of the Transmountain Highway Showing the Location of the Various Camps

the summit. At this time automobiles or trucks could only reach Avalanche Creek, a point 4.8 miles from the contractor's chosen headquarters site. Hence it was necessary that all supplies and equipment be packed in on horses from that point. Of this distance 3.2 miles of highway were under construction by the park service, however, and were finished during the summer. In order to reduce packing to the minimum and provide a means of getting in heavy equipment as well as supplies, the construction of the lower part of the project was begun immediately.

At the same time construction of Camp No. 2 at Station 410, "the Loop," was begun. Work at this point of the highway was vital to the success and progress of the contract. Heavy cliffs on the upper line had to be shot away before work on the lower part of the road could be attempted. This camp, located on the steep mountain side, was equipped and supplied entirely at first by means of pack horses. When it is considered that the average load for such a horse is 150 pounds, the task of the contractors in maintaining a good camp for 50 men may be readily seen.

HOUSING

Log frames were built and covered with canvas for the cook and mess houses. To floor these buildings

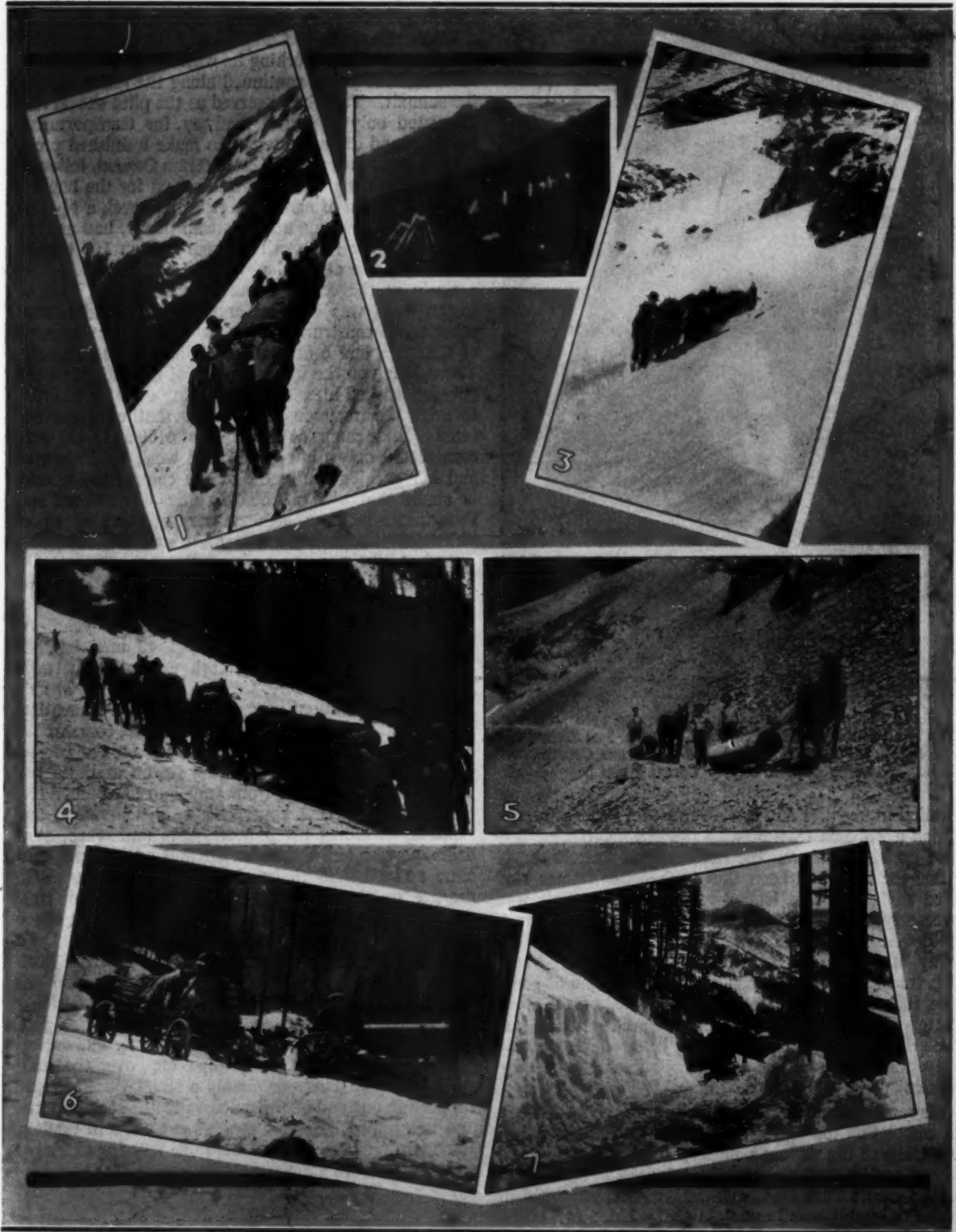
been blasted out. Half tunnel or over-hanging sections were designed for the road at this point so that careful drilling and shooting were required.

At Station 443 a tunnel 200 feet in length had been planned to pierce a high prominent cliff. Equipment could not be transported along the right-of-way because of this cliff until the tunnel had been constructed. Hence to expedite the work of getting more and heavier equipment on the job, a "tote" road was constructed from Station 500 along the lower levels beside McDonald Creek, around the tunnel site and up to the "Loop." This work was done by the gas shovel in the last of the working season of 1925 and in the early part of 1926.

On October 31, 1925, the coming of snow caused a shut down of the work with about 5 per cent of the actual contract completed. However, much more than this had in reality been accomplished in the way of organizing and preparing for the following seasons.

WORK IN 1926

In April, 1926, work was again resumed by the contractors. A comparatively light snow fall during the winter made early work possible. However, even with such favorable circumstances, the snow at this time prevented the use of either automobiles or horses in



BUILDING THE TRANSMOUNTAIN HIGHWAY AT GLACIER NATIONAL PARK

1. Hand methods employed in moving a Sullivan air compressor to Station 45 in June, 1927. 2. Pack horses loaded with lumber for Camp No. 5, with only one more mile of 20 per cent grade to go. 3. Bringing in supplies by pack train. 4. Use of horses in moving a Sullivan compressor over a snow slide 1,000 feet wide and from 20 to 40 feet deep, at Station 150 in July, 1927. 5. Using a "go-devil" to haul culvert pipe to the summit along the construction trail at Station 40. 6. Fordson tractor hauling in supplies by wagon en route to Camp No. 1 from Belton. 7. Shovels removing a snow slide at Station 430 in April, 1927.



A Portion of the Transmountain Highway as Seen from the Top of Oberlin Mountain, Showing Camp No. 5 at Station 98, the Right-of-Way of the Road, and Numerous Construction Trails Built to Supply Camps 5 and 6

hauling in supplies and equipment. To meet this condition a Fordson tractor, with full crawler tracks, was first used to break out the road to headquarters camp. After the road had been thus broken the tractor was used to haul a sled loaded with supplies. This was necessary over the last 5 miles of the road to camp until well into the month of May. As the snow melted away, a wagon was substituted for the sled. Later this tractor was put to good use in the hauling of gasoline, fuel oil, powder, steel, provisions, etc., up the steep "tote" road to Camp No. 2. The grade of the last mile of this road averaged 20 per cent, which made it very difficult for horses, while the tractor proved very efficient.

As soon as Camps No. 1 and 2 were opened, the work of completing the "tote" road and constructing numerous trails to the various points on the right-of-way was begun and rushed as much as possible. An existing trail, Granite Park trail, was widened and improved in order to establish and maintain Camp No. 3 at Station 308. From this camp, holding about sixty men, crews worked along the right-of-way in both directions until another camp could be built at Station 267.

This latter Camp, No. 4, was soon filled with workmen, principally station men, who began some of the heavy rock work from Station 216 to 270. Four station crews, totaling sixty men, handled within these

stations, 59,500 cubic yards of solid rock excavation.

While this work at Camps 3 and 4 was being done, the gas shovel was working its way to the "Loop" and, reaching that point, continued along the grade toward the summit. This shovel served as the pilot shovel and excavated only a partial roadway for transportation purposes and did not attempt to make a finished product. A second shovel, a $\frac{3}{4}$ -yard steam Osgood, followed to complete the excavation, also caring for the hauling and distribution of material. A third shovel, a $\frac{3}{4}$ -yard Erie, fuel oil burning and of steam power, had arrived on the job and was working from Station 500 toward the tunnel site at Station 443.

Early in the season another existing trail, that to Logan Pass, was widened and improved and several other trails constructed to make possible the opening of Camps 5 and 6 at Stations 98 and 20 respectively. These, being on the upper portion of the project, could only be reached after much shoveling of snow in order to cross the numerous large slides that were encountered. These camps at elevations of 6100 and 6600 were constructed only after much hard work by both men and horses. To the credit of the contractors it may be stated that with all the difficulties encountered and the expense incurred, good sanitary quarters were provided for the workmen and most excellent food furnished at all times.

As soon as Camps 5 and 6 were ready, station crew were sent in to do the excavation which the power shovels would be unable to reach for another year. At Camp 5 four crews totaling about 40 men handled 35,500 cubic yards of solid rock excavation between Stations 98 and 125. At Camp 6 one crew of 24 men handled 31,200 cubic yards of solid rock excavation, between Stations 0 and 38. At this point some of the heaviest and best executed rock work on the project was accomplished. The working season at these two upper camps was about from July 1 to September 15.

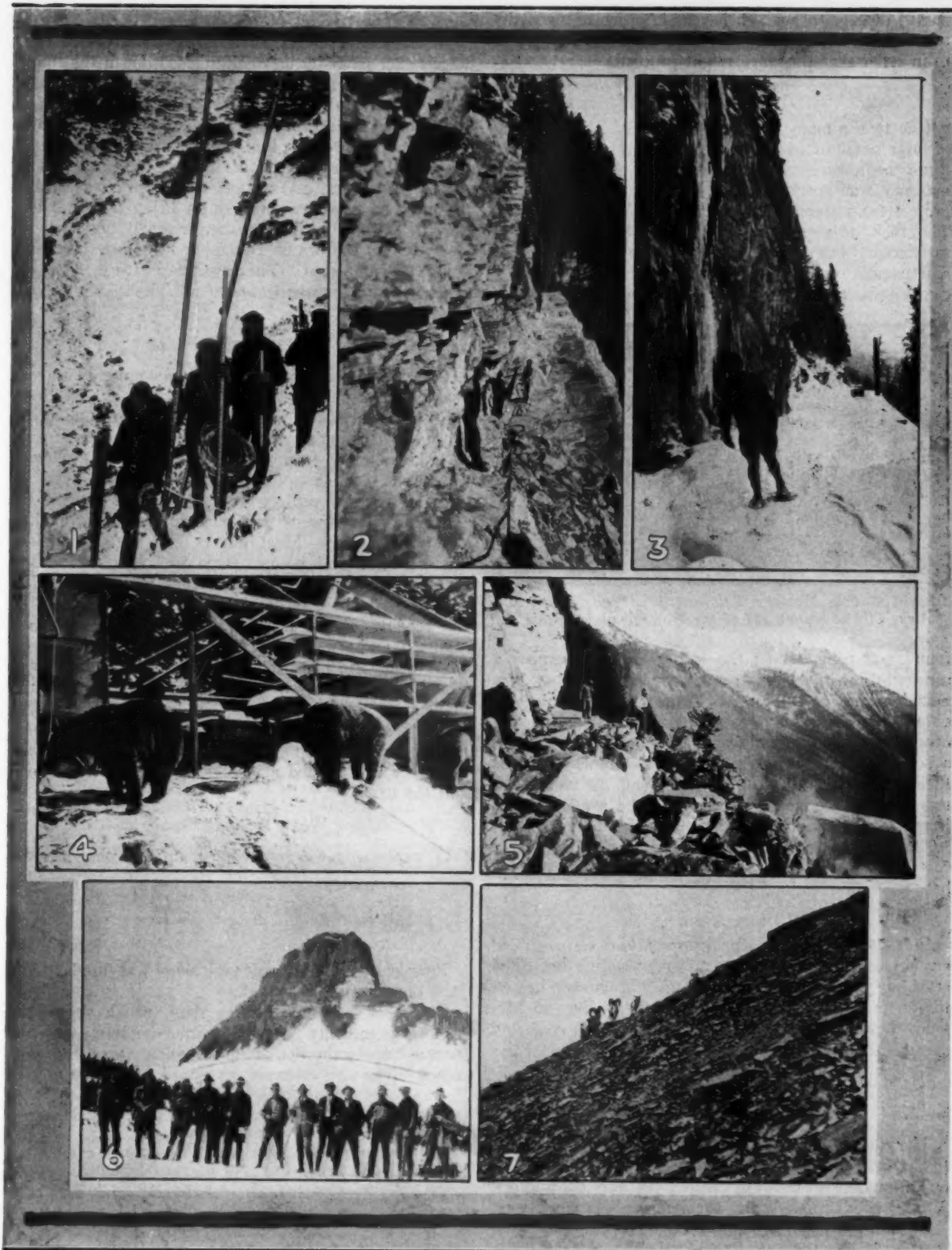
For work at these upper camps, all equipment and supplies, including compressors, cars and track, steel drills, powder and dynamite, air and water pipes, gasoline and oil, had to be either packed on horses or dragged up the five miles of steep, narrow trail from Camp 1, a climb of between 2,500 and 3,000 feet elevation.

For use in drilling, 4 single-hammer Sullivan portables, one double-hammer Sullivan portable, and one double-hammer Ingersoll-Rand portable were used.

A simple contrivance, a "go-devil," was made good use of in hauling such items as gasoline, oil, culvert pipe, steel drills, rails, water pipe, etc., over the trails to the camps. This was simply a small V-shaped sled supporting one end of the culvert pipe or such material and was pulled by either one horse or two in tandem. Each trip required not less than one day from Camp 1 to the upper two camps.

SNOW FALL

This project, being situated well up in the Rocky Mountains of Northern Montana naturally is subject to heavy snow fall and resulting long and deep slides. In 1926 even as late as June 19, snow fell heavy enough to crush down several of the tents at Camp 5. The combating of such slides was just another of the contractor's problems. One such large slide must be



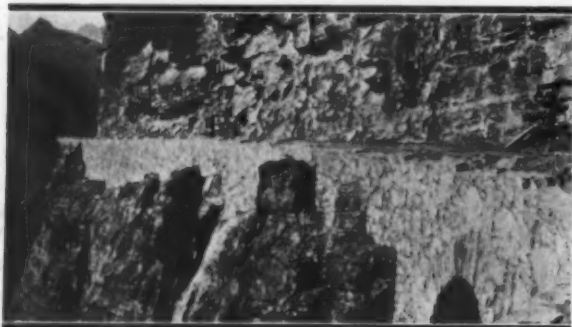
TYPICAL SCENES DURING THE CONSTRUCTION OF THE TRANSMOUNTAIN HIGHWAY

1. Party of locating engineers, U. S. Bureau of Public Roads. 2. Starting the Transmountain Highway on a perpendicular rock wall approximately 2,000 feet high. 3. Traveling along the partly completed road after a fine snowfall. 4. The ever-present bears at Camp 5, Station 268. 5. Heavy rock construction along the side of the mountain. 6. Contractors and their engineers making an inspection of the highway route at the time of taking bids, June 12, 1925. 7. Rocky Mountain sheep who were the only natives encountered on Logan Pass at the summit of the Transmountain Highway

passed over or through each year in order to reach the project. Both hand and power shoveling were resorted to in order that the work might proceed.

RUBBLE MASONRY

Due to the many cliffs passed through, the building of large amounts of retaining walls and guard rails became necessary. For this purpose cement rubble masonry was specified, such being best suited to the project from standpoints of both cost and appearance. The rock adjacent to the various sites was always satisfactory but the supplying of the necessary sand and cement were problems for the contractor. The cement was readily obtainable but the sand had to be



Cement Rubble Masonry Retaining Wall and Guard Rail Along Cliff at Station 382 of the Transmountain Highway

found and provided on the job. For this purpose a sand washing plant was constructed on a bar of McDonald Creek at Station 628 from where all sand was obtained. The plant was simple in construction and operation. The material was elevated and dumped over a screen to remove the over size, the remainder was then carried in a flume with water and the balance of the coarse material removed, while the sand was collected in a settling box at the end of the flume. About 1,000 yards of sand have been delivered to date at a cost of approximately \$5.00 per yard equally divided between producing and delivering.

SURFACING

In 1926 and 1927, surfacing operations were carried on, beginning at the lower end and working up. The crushing plant was established at Station 641 but in the latter part of 1927 it was moved to a bar on McDonald Creek at Station 628. The equipment consisted of the following:

- 1 No. 2 Aurora Jaw Crusher
- 1 4½" Traylor Gyrotory Finishing Crusher
- 1 Double-Drum Belted Hoist for dragline
- 1 30 x 12" Western Revolving Screen
- 1 90-H.P. Russell Steam Tractor

The material obtainable at these sites proved difficult to handle due to "muck" and water, so that the crushing operations were not satisfactory to the contractors. A total production during the two seasons work was:

Base rock.....	5,231 cubic yards
Top rock.....	6,409 " "
Maintenance.....	607 " "

This total of 12,247 cubic yards of material crushed made an average daily output of about 60 cubic yards. A new crushing plant has been started well up on the project, using new equipment, and a larger output is anticipated.

TUNNELLING

In October, 1926, after the other parts of the work were either partially or wholly closed down, the tunnel construction at Station 443 was begun. It was to be 200 feet in length with a width of 20 feet and a height of 18 feet, the upper portion being in the form of a semi-circle of 10-foot radius. In addition, two windows were to be constructed for lighting purposes. This work was sub-let, and although the work was rushed as much as possible, three shifts being at times employed, extremely cold weather made it necessary to close this work down on December 15 before the tunnel could be completed. The low temperature, —32 degrees, made it impracticable, if not impossible, to continue the work.

TROUBLE FROM BEARS

One difficulty or impediment not encountered on road grading as a rule was the trouble from bears. Not even log cabins, unless floored, were free from their pillaging. Since the harming of animals within the park is strictly forbidden, many schemes were devised and followed to protect food supplies. One means employed by clearing forces to protect their lunches was to hang the food in a small tree with a cross-cut saw hung against the trunk below. Meat houses had roofs and sides studded with nail points. One was supplied with a lifting walk resembling the bridges across the moats of old. The best protection was finally found to be the feeding of the bears like a farmer feeds hogs: regularly and generously. At the upper camp, 6, grizzly bears made life miserable for the men and their cook. The black and brown bears were finally tamed and made into pets, but the grizzly bear has a different nature. Many times the meat house was demolished. When the situation became most critical, a Park Ranger was stationed at the camp to protect the men and the camp.

WORK ACCOMPLISHED

Of explosives, the following quantities were used:

20% Dynamite.....	170,500 lbs.
40% ".....	138,500 "
60% ".....	6,000 "
Black Powder.....	135,000 "
Total.....	450,000 lbs. or 225 tons

Practically 1 pound of explosives was used to the yard of material excavated.

The work accomplished to date, which shows the project practically 85 per cent complete, may be summed up in the list of the principal items last estimated. The unit contract prices are also shown.

	Amount	Unit Prices
Clearing.....	67 acres	230.00
Grubbing.....	44 "	250.00
Excavation, unclassified.....	465,246 cu. yds.	1.14
Crushed rock, base.....	5,200 "	2.35
Crushed rock, top.....	6,485 "	2.60
Crushed rock, maintenance.....	548 "	2.60
Tunnel excavation.....	3,703 "	6.00
Half tunnel excavation.....	21,164 "	1.50
Cement rubble masonry, bridges.....	121 "	16.00
Cement rubble masonry, arch culverts.....	380 "	18.00
Cement rubble masonry, headwalls culverts.....	116 "	15.00
Cement rubble masonry, retaining walls.....	5,127 "	15.00
Cement rubble masonry, guard rails.....	447 "	14.00
Class "A" concrete, culverts.....	76 "	40.00
Class "A" concrete, bridges.....	142 "	35.00
Class "C" concrete.....	45 "	38.00
Reinforcing steel.....	14,900 lbs.	0.10
Corrugated Metal Pipe Culverts:		
18 inches.....	1,943 ft.	3.00
24 inches.....	766 "	4.00
30 inches.....	108 "	6.00
Hand laid embankment.....	3,302 cu. yds.	3.75

PERSONNEL AND EQUIPMENT

During the peak of the construction work, when all six camps were being operated to full capacity, a force of about 300 men was employed. Both members of the contracting firm were on the job continuously and using their best efforts at all times to rush the work to completion. In addition to the men employed the following equipment was used:

- 60 pack horses
- 10 teams
- 3 power shovels
- 2 Ford trucks, dump beds for sand and cement hauling
- 1 4-ton White truck
- 1 2½-ton White truck
- 1 5-ton Republic truck
- 1 5-ton Standard truck
- 1 5-ton Moreland truck
- 1 Fordson tractor
- 2 7-ft. Austin team graders
- 1 complete rock crushing plant
- 1 sand washing plant
- 4 single-hammer portable compressors
- 2 double-hammer portable compressors
- 3 3-ton Plymouth gas locomotives
- 1 4-ton Plymouth gas locomotive
- 12 2-yd. Western dump cars, 24-in. gage
- 3,000 ft. track, 20-lb. rails
- 10 Waugh clipper drills, jackhammers
- 4 BCR 430 Ingersoll-Rand Jackhammers
- 1 DCR Ingersoll-Rand Jackhammer

The problems of the project, from a contractor's standpoint, were not in the amounts of the various items to be moved, but in overcoming the obstacles placed by nature against their removal. Had it been possible to get proper equipment to the work it would have been a comparatively simple matter to construct the highway. By constantly being on the job and attacking each problem of construction personally, the contractors have been able to accomplish the best results in the short time allowed each season by the weather conditions that prevail in the Rocky Mountains of Glacier Park.

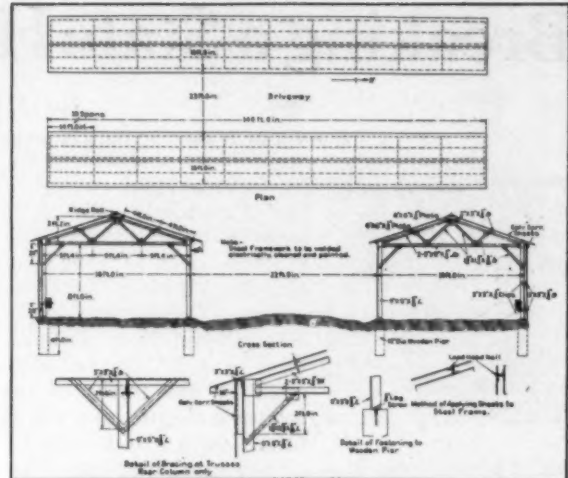
The construction and engineering was directed and supervised from District No. 1 of the Bureau of Public Roads at Portland, Oregon, J. A. Elliott having charge of all co-operative Park work. J. Ross Eakin, Park Superintendent, residing at Belton, Montana, has actively co-operated in the work, assisted by T. C. Vint, Landscape Engineer for the Park Service. W. G. Peters, Associate Highway Engineer, was Resident Engineer on the project for the Bureau of Public Roads.

40-Car Garage Fabricated from Scrap Steel

A 40-CAR garage has been erected by the Dallas Power & Light Co., Dallas, Texas, for the protection of employees' cars, utilizing structural steel that would otherwise have been scrapped. The garage was of welded construction, one of the company's single portable General Electric welding units being used for the work.

The structure was made of a steel angle-iron framework, covered with corrugated galvanized iron. It consists of two units, each 16 x 140 feet, divided into 10 spans each 14 feet wide, each unit being capable of covering 20 cars. The units face each other with a 22-foot driveway between.

The steel used was salvaged from the framework of an outdoor switching structure which became obsolete with the addition of generating equipment to the power plant. The varying lengths of the steel members removed from this structure, together with the numerous holes already punched for the switching structure would have made it necessary to splice or junk the greater part of the steel if a type of construction other than welding had been used.



Detail of Steel Arc Welded Garage

The roof trusses are of the simple Fink type. The upper and lower chords are made of two 2 x 2-inch angles welded together back to back. The other members of the trusses are made of 1 x 1-inch angles. All members of the trusses are tied together with ¾-inch plate and the trusses are tied to the columns in a similar manner. The span of each truss is 16 feet and the height of the center is 3 feet 2 inches. The purlins for the roof are 2-inch angles, with one edge welded to the truss. This leaves a flat side of the angle for the corrugated iron roof to rest on. The columns are made of 5-inch angles, welded to the plate at each end of the truss. The back columns are braced along the run and to the truss with short knee braces. The columns are spaced on 14-foot centers. The angles to which the corrugated iron walls are fastened are welded on, the same as the purlins. All welds were of the strap and butt type. The columns are fastened to the wood foundation by means of lag screws through angle clips welded to the base of the columns, these being the only bolts in the entire structure. The roof and walls are made of 29-gage corrugated galvanized iron roofing fastened on with 6-inch lead-head roofing nails.



Part of 40-car Garage Entirely Welded from Steel Taken from a 13,200-volt Substation Structure at Dallas, Texas

Any job is like a baseball game. You can easily advance from first to second and from second to third and even from third to home with someone else's help; getting to first is entirely your own job.

Breaking a State Highway Bottleneck

By J. P. Hall

Division of Highways, State Department of Public Works, Sacramento, Calif.



THE widening and paving of San Francisco's only state highway outlet to the south to Los Angeles, has been completed and the breaking of the notorious Colma "bottleneck" accomplished. Six traffic lanes, three in each direction, separated by the tracks of the peninsula electric cars, will in future carry the automotive

traffic with increased safety and speed from San Francisco into San Mateo County and to all points south. The tracks of the Market Street Railway Co. will occupy the center car line as an added precaution against accidents, and two 10-foot strips will be reserved for sidewalks.

A \$700,000 PROJECT

In round figures, the cost of the 1½ miles of reconstructed highway approached a sum of \$700,000, exclusive of engineering costs. Figures for the project are as follows:

Cost of right-of-way.....	\$165,000
Grading and re-aligning.....	137,000
Paving.....	209,000
Cost of moving railway.....	110,000
Other improvements.....	53,000
Total	\$674,000

Agreement with the City and County of San Francisco for an appropriation of \$150,000, with the County of San Mateo for \$50,000, and with the Market Street Railway Co. for \$55,000, and the untiring support of the various county and municipal authorities made it possible for the California Highway Commission to award the contract for the grading and structures of this portion of the state highway from Colma to Cypress Lawn Cemetery. The award was made on October 7, 1926, to the Kaiser Paving Co.

Many months were required by the contractors in moving a large number of buildings and other obstructions and it was only in 1927 that the entire project took shape along the new alignment. The setting of poles, including those of the Market Street Railway and the telephone and telegraph lines back of the proposed curb line, and the moving of all old poles in the old right-of-way, made a great change. As quickly as the new alignment was cleared, the Market Street Railway Co. moved its tracks to the center line of the new right-of-way and rebalasted and placed new ties.

TRAFFIC MAINTAINED

There was little or no interruption in traffic during construction. Particular care was always taken to

see that detours were of adequate width and proper surfaced to avoid congestion or inconvenience to the traveling public. The width of the former pavement provided only a 24-foot surface for both north and south bound traffic. This 24-foot strip is still in place in a number of locations in the project and it was a strange sight on a Sunday afternoon during construction to see the broad and clear expanse of the 124-foot right-of-way void of buildings, while the narrow 24-foot old pavement was jammed with traffic.

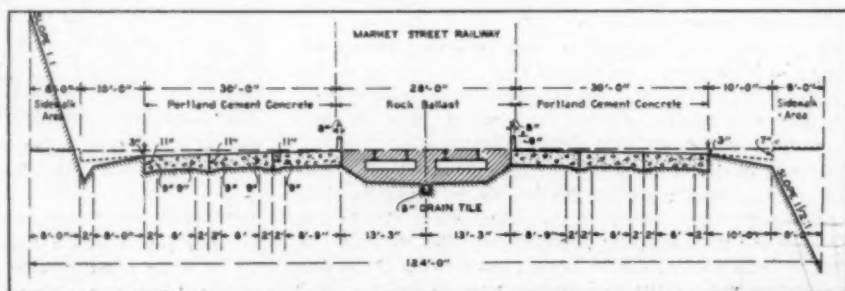
PAVED WITH CEMENT CONCRETE

As soon as grading operations had been completed to a point where it was advisable to proceed with the paving, plans and specifications were prepared and bids were received on June 13, 1927, to pave the project, 1½ miles in length, with portland cement concrete. Some of the major items of the paving contract were: 435,000 square feet preparing and shaping subgrade for pavement; 13,000 cubic yards class "A" portland cement concrete in pavement; 390,000 pounds reinforcing steel in pavement and curbs; 1,600 tons of asphaltic concrete mixture repairs and thickening of asphaltic surface on portions of the old pavement within the area of the new improvement.

These major items are a portion of a contract awarded to Hanrahan Co. of San Francisco, June 23, 1927. The contract specified that all work should be completed within 75 days after the approval by the Attorney for the Division of Highways whose approval on July 25, 1927 set the date for completion on November 1, 1927.

TRAFFIC WAY 124 FEET IN WIDTH

The improvement provided for work within the entire width of the right-of-way of 124 feet. The rebalasted and realigned street railway tracks of the Market Street Railway Co. are on 13-foot centers and occupy the central 28 feet of the right-of-way. These tracks are ballasted in rock under which is laid a 6-inch longitudinal tile drain for draining the track area. The completed open ballasted railway tracks will remain in this condition and will be curbed to prevent vehicle traffic from driving on to the area reserved for street car tracks except at specified paved crossings which provide for cross travel.



A Typical Cross Section of the New Road Between Colma and Cypress Lawn Cemetery. The Horizontal Scale Is Three Times the Vertical Scale.



BUILDING THE NEW CONCRETE HIGHWAY AT COLMA, CALIF.

1. Laying bottom course of pavement. 2. Screeding top course. 3. Final hand finish of concrete surface.

SIXTY FEET OF PAVING

On each side of the central 28-foot strip reserved for the railway tracks there was constructed a 30-foot portland cement concrete pavement, consisting of three 10-foot strips, 9 inches thick in the central 6 feet and increasing to from 9 inches to 11 inches in the outer 2 feet. The slab adjacent to the center was constructed 10 feet 9 inches wide, the additional 9 inches being for the support of the concrete curb which is doweled to the pavement base.

CONSTRUCTION DETAILS

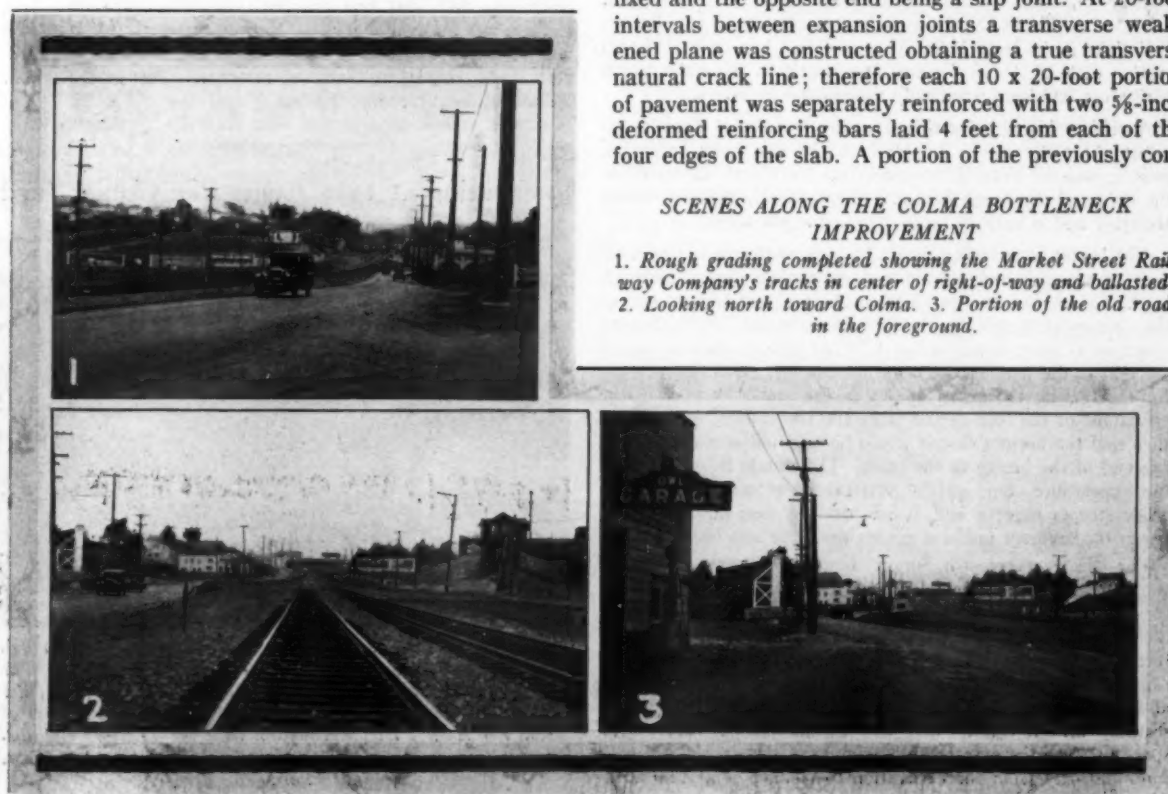
Expansion joints were provided for at 60-foot inter-



vals and consisted of prepared bituminous joints. Concrete slabs at expansion joints were doweled with five $\frac{3}{4}$ x 24-inch dowels on 27-inch centers, one end being fixed and the opposite end being a slip joint. At 20-foot intervals between expansion joints a transverse weakened plane was constructed obtaining a true transverse natural crack line; therefore each 10 x 20-foot portion of pavement was separately reinforced with two $\frac{5}{8}$ -inch deformed reinforcing bars laid 4 feet from each of the four edges of the slab. A portion of the previously con-

SCENES ALONG THE COLMA BOTTLENECK IMPROVEMENT

1. Rough grading completed showing the Market Street Railway Company's tracks in center of right-of-way and ballasted.
2. Looking north toward Colma. 3. Portion of the old road in the foreground.



structed state highway was used as a base for the new improvement. The old width of 24 feet was increased 6 feet to a total of 30 feet by the construction of a concrete shoulder 10 feet wide, 4 feet of it overlapping the asphaltic pavement and raised to the elevation of the new crown. The remaining portion of the area over the old pavement has been resurfaced with asphalt concrete and finished to a true cross section conforming to the standard provided in contrast.

In order to facilitate the rapid placing of concrete pavement, Hanrahan and Co. constructed bunkers and a proportioning plant on the railroad siding adjacent to the center of their work. All materials were loaded in dry batch compartment trucks and hauled directly to the subgrade where a 6-sack MultiFoote paver received the material and placed the concrete directly in 10-foot-width sections. It was the purpose to lay the concrete pavement on this line change for the immediate use of traffic and to allow the moving of the railway tracks from the old location to the new right-of-way, at the same time obviating two dangerous crossings of these street-car tracks. Traffic was routed over one or another of the 10-foot strips which permitted the pouring and curing of other pavement sections on opposite sides.

This particular highway, Route 2, carries the largest amount of traffic of any road in the state as shown by a 16-hour count taken Sunday, July 17, 1927. This figure has already exceeded 30,000 since this improvement was completed.

Verendrye Bridge Completed

WITH the construction during the last year of two bridges across the Missouri River at Sanish and Williston, North Dakota has completed two important links in its state highway system and has connected this system with McKenzie County, the largest in the state, which heretofore had been practically surrounded by rivers.

A satisfactory site for this structure was found directly opposite the town where the bluff on the east bank formed a good approach. Foundation conditions were very favorable as the depth of the tough blue clay is practically uniform across the river and is only 20 to 28 feet below low water.

The bridge is 1150 feet long. Its superstructure is four 273-foot truss spans and one 55-foot deck plate girder approach span. The second main span from the east end is level and at the clearance required by the War Department. From this the other spans slope downward at 2.19 per cent to the east and 4 per cent to the west. Some consideration was given to a scheme for eliminating the sharp breaks in the grade by making the elevations of the tops of the piers and the camber of the span such that the bottom chords would be on a uniform curve from one end of the bridge to the other. This would have improved the appearance, but, as the vertical curve would make the grade steeper at each end, it was decided that the breaks between the different uniform grades would be less objectionable.

For the river piers at Sanish, reinforced concrete caissons were sunk by open dredging. Each caisson is 17 x 51 feet at the bottom with octagonal ends. In the second 6 feet up from the bottom a 30-inch offset all around makes the shaft 12 x 46 feet. To counteract the strong tendency which bell bottom caissons have to lift during sinking, a wall of timber was built all around flush with the outside of the cutting edge and securely braced against and tied to the caisson shaft. The space between the outer sheathing and the shaft was filled with sand and clay from the excavation to balance some of the in-



The Completed Verendrye Bridge

ward pressure on the timber and to provide dead weight for sinking. Three dredging wells, 7 x 9 feet, extended down through the shaft and flared out to include the whole area of the base at the bottom.

On account of the comparatively shallow depth of the overlying sand, all three of these caissons were sunk 15 feet into the firm blue clay as a precaution against scour. The caisson for the middle pier was sealed 40 feet and the other 38 feet below low water. Each caisson was unwatered as soon as the cutting edge had penetrated the clay and excavated and sealed in the dry.

Practically all of the hoisting work on this bridge was done by Mundy 60-horsepower, 3-speed gasoline hoists. Each had three drums and attached swingers. These hoists operated buckets for digging the spoil from the caissons, poured the concrete, handled the stone work and finally placed all the steel.

A contract for the complete structure of the Sanish Bridge was awarded April 22, 1927, to the Minneapolis Bridge Co., which completed it on June 28, 1927. The original contract price was \$422,290 and the final estimate \$425,553. Isak Helseth was Superintendent for the contractor, L. M. Blumfeld was Resident Engineer for the State Highway Department, with P. M. Hegdal in charge of materials. This bridge is now known as the Verendrye Bridge.

Excavation at 14½ Cents Per Cubic Yard

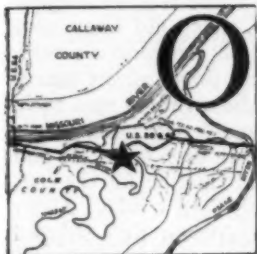


The Palo Alto City Reservoir from Which 14,360 Cubic Yards of Dirt Were Removed at a Bid Price of 35 Cents Per Cubic Yard. The Next Lowest Bid Was 60 Cents. The Caterpillar Tractors Were Operated a Total of 592 Hours at a Cost of \$3.50 Per Hour. Dirt Excavation with the Tractors and Ball Wagon Graders Cost the Contractor 14½ Cents Per Cubic Yard

An Unusual Grading Job

By Carl W. Brown

Assistant Chief Engineer, Missouri State Highway Commission



NE of the present outstanding construction jobs in Missouri is that of regrading a part of the original Federal Aid Project No. 1, in Cole County, and constructing the drainage structures thereon preparatory to surfacing. This work is on the road running from Jefferson City east to the Osage River, which is covered

jointly by U. S. Route Nos. 50 and 63 for this distance.

U. S. Route 50 is one of the two main roads connecting Kansas City and St. Louis, and passes through Jefferson City, the state capital. U. S. Route 63, also passing through Jefferson City, is one of our main north and south routes. The sections now being regraded are used by both routes and carry a very heavy traffic.

The original Federal Aid Project No. 1, being 26.39 miles in length, extended from the west county line of Cole County through Jefferson City to the Osage River. This project, which was constructed during 1918-19, was the first federal aid project in this state financed and built under the Federal Aid Act of Congress passed in 1916. The original project included grading, construction of small bridges and culverts, and surfacing with a 16-foot strip of gravel. An old bridge over the Moreau River was used in place in the first project. The cost of this project was \$160,343.31, and the new project takes the place of approximately two-fifths of the original location.

Owing to the limited amount of money available for construction in 1918, it was impossible to get the best alignment and to reduce the grades to our present standard. In many places curves of 150-foot radius and grades as high as 9 per cent were allowed. On the original project there were 72 curves; while on the new project this number was reduced to 22. The right-of-way for the original project was only 40 feet in width, while for the new location an 80-foot right-of-way has

been secured throughout, with the exception of a short distance within the city limits of Jefferson City.

That part of the road now being regraded is divided into three Federal Aid Projects as follows: 1-A, 2.834 miles; 1-B, 4.278 miles, and 1-C, 2.901 miles, or a total length of 10.013 miles. The division of the work into three sections was necessary, due to a provision in our state law, which specified that the work shall be let in projects, the length of which shall not exceed five miles. The length of the original project between Jefferson



Looking West Toward the Bogg's Hill Cut Showing the Shovel, Hoist and Track Layout

City and the Osage River was 11.582 miles; therefore, by relocation, a saving of 1.569 miles has been accomplished. All curves in the new project have a radius of 1,000 feet or more and the roadway has a maximum grade of 6 per cent.

As Section A follows the original location for three-fourths of a mile, traffic is being carried around this section over a graveled county road. However, Sections B and C are entirely on a new location and traffic is carried over the original highway.

The new location is through some of the hilliest country we have in this section of the state, and it will be noted, by referring to the accompanying map, that the route is practically at right angles to the prevailing drainage, the ridges being very high and dropping off abruptly to the river and small creeks. It is, therefore, impossible to get good alignment and low grades without some very heavy cuts and fills.

QUANTITIES

The estimated quantities for major items in the three sections are: 73,500 cubic yards of solid rock, 188,000 cubic yards of earth excavation, 5,500 cubic yards of loose rock, 105,000 cubic yards of borrow and 436,000 station-yards of overhaul. The smaller items include 944 lineal feet of 15-inch corrugated iron pipe, 112 lineal feet of 18-inch corrugated iron pipe, 915 lineal feet of concrete gutter, 540 lineal feet of cobblestone gutter, 1,800 cubic yards of class B* concrete, 175,000 pounds

* Class B concrete is a 1:2:4 mix, and is used for all reinforced work, except such as is included in class A, for copings and bridge seats on piers, abutments, and for unreinforced work of a thickness from 4 1/4 inches to 12 inches, inclusive.



View Near the Center of the Bogg's Hill Cut Looking East. The Steam Shovel is Cleaning Up the Second and Final Lift



High Fill East of Bogg's Hill Cut Showing Method of Widening Fill by the Use of Industrial Car

of reinforcing steel for concrete masonry, and other miscellaneous items, such as clearing and grubbing, etc. In addition to the foregoing, the three bridges are estimated to require 2,500 cubic yards of excavation, 3,000 feet of plain piling, 2,000 feet of cresoted piling, with a total estimated cut-off of 600 feet, 22 yards of class A,‡ 975 yards of class B, 535 yards of class X‡ concrete, 186,000 pounds reinforcing steel, and 189,000 pounds of structural steel.

PRICES

The unit prices for all sections are \$1.40 per cubic yard for solid rock excavation, \$0.648 for loose rock, \$0.294 for earth and borrow excavation, \$0.022 for overhaul, \$0.049 for reinforcing steel, \$17.15 per cubic yard for class B concrete masonry in culverts and headwalls, \$17.22 to \$17.73 per cubic yard for class B concrete masonry in bridges, \$17.64 per cubic yard for class X concrete masonry, and \$39.28 for class A concrete masonry. On all concrete work the foregoing prices do not include cement and coarse aggregate, as these materials are furnished by the state. A total of 5,400 barrels of cement, and 3,220 cubic yards of coarse aggregate will be required.

CONTRACTORS

The letting was held January 28, 1927, and twelve bids were received. The contract was awarded to the C. P. O'Reilly Construction Co., of St. Louis, at a total price of \$385,077.35 for the three sections. The work on all sections is being done by subsidiary companies of the C. P. O'Reilly Construction Co., with L. E. Greathouse as general superintendent of the work. The grading work on Section A is being done by McNamee Brothers, and Sections B and C by Murphy Brothers; the culverts and bridge work on all three sections is being done by J. R. Hancock. Work was started on April 19, 1927.

ROCK EXCAVATION ON SECTION A

On Section A there are two elevating grader outfits—one Stroud and one Austin, and two Erie steam shovels, one of $\frac{3}{4}$ -cubic-yard and one of 1-cubic-yard capacity, Koppel side-dump cars, a Sullivan air compressor and drill sharpener. Also on this section is a Fordson tractor with two-speed hoist, two Holt Caterpillar and two Best Caterpillar tractors. Western dump wagons are

used with the elevating graders. On Sections B and C there are one Austin and two Russell elevating graders, and Erie gas-air shovel and Western side-dump cars, and Western wagons are used with the elevating graders. There are two Holt Caterpillars and one Best Caterpillar tractor. The tractors on both sections are used to pull the elevating graders. On the extreme long hauls on Sections B and C three of the Western wagons were hooked behind the tractor, which did away with the use of teams and drivers. On the concrete work there were two bridge outfits and three culvert gangs. The bridge gangs, consisting of about twenty men each, are equipped with steam hoists and derricks and Jaeger mixers. The pile drivers used were drop hammers and were run from the steam hoists. Hauling for the concrete work was done mainly with Ford trucks. About sixty-five cars of contractors' equipment were shipped in for this job.

The heaviest rock work is located in Section A, there being 63,500 cubic yards of earth excavation, 1,500 cubic yards of loose rock excavation, 31,000 cubic yards of solid rock excavation, approximately 6,000 cubic yards of borrow, and 161,000 station-yards of overhaul. The solid rock excavation is all in one cut, which is locally known as Bogg's Hill, and located just east of the city limits of Jefferson City. This hill was cut approximately 15 feet to secure a 9 per cent grade on the original Federal aid project. These grades have now been reduced in the new project to 6 per cent, and the road has been widened, making the total cut of earth and rock approximately 48 feet on the high side.

This cut was made in two lifts, using a steam shovel, side dump cars, and a small gasoline hoist. The zero point of the cut and fill in the large cut corresponds very closely to the zero point in the original project. The track for the dump cars is, therefore, laid upon the old grade, thus using but very little trestle, and permitting the cars to dump to the side, while building up the new grade. Cars are let down from the steam shovel by gravity and returned in two car trains by the gasoline hoist, a short distance below the steam shovel. At this place a switch is installed and cars are then spotted, one car at a time, by mule teams.

Owing to a peculiar formation of the material, the contractor is experiencing considerable difficulty in drilling and shooting the material in the rock cuts. There are several very hard strata of limestone, at various depths in the cuts, which contain many nodules



Bulldozer Used on Section C to Place the Dirt Over the Sides and Ends and to Compact the Fill

‡ Class A concrete is a 1:2:3 mix, and is used for railings, ornamental works and slabs of 4 inches or less in thickness. Class X concrete is a 1:2:3½ mix, and is used for superstructures (except rail), for reinforced concrete slab and deck girder spans, and for concrete floors on steel spans.

of chert. The drilling is very slow in these strata and the drill steel is quickly dulled. When these strata occur above grade the force of the powder is almost entirely expended below them in the softer rock, while the hard strata are broken up in large boulders or slabs, which have to be drilled and shot again before being loaded and placed in the embankment.

Where the hard strata of limestone occur in the bottom of the cut, they are scarcely broken at all by dynamite, and it is often necessary to strip the softer material off and drill and shoot the lower layer a second time. This increases materially the cost of the drilling and shooting and often delays the shovel crew.

The contractor found that the efficiency of the jack hammers was increased by the use of a compressed air drill sharpener, as he was then assured of having sharp steel on hand at all times, as well as assured of having a uniform gage and shanks at a minimum cost. The sharpener was placed at the cut near the compressor and air was supplied to the sharpener, forge and jack hammers at the same time. Only one man is required to sharpen and temper the drill steel. It is very often difficult to get shanks welded on the drill steel satisfactorily by hand methods and delays are incurred by breaking shanks, but machine sharpened steel reduces these delays to a minimum and fewer holes are lost.

The maximum length of haul from the large cut is approximately 1,500 feet, and three cars of 4-cubic-yards capacity are sufficient to handle the rock at practically all times. On the first lift the holes were put down 16 feet, and on the second lift to grade. Extreme care had to be used in the shooting on this section, as many houses are located close to this work. Forty per cent dynamite was used, and a total quantity of 40,000 pounds was required.

CUT EXCEEDS FILLS

In making this cut of 31,000 cubic yards of solid rock, it was found that there was an excess of material, more than enough to make the fills as planned. This was due to two causes: first, not enough swell was shown on the original plans. In balancing the excavation, only 35 per cent swell was figured and, from indications, this turned out to be nearer 40 per cent. On the above yardage such an increase made a difference of almost 1,600 cubic yards. The second cause was the overbreakage in the rock, which was not allowed for in the plans. This overbreakage averaged on the entire cut almost two feet back of the theoretical section, and for the entire cut amounted to almost 3,000 cubic yards. This extra breakage was due to the condition of the top layer of rock. The first depth of ten feet was not a solid ledge, but of a weathered and disintegrated limestone; and when shot, broke back as much as five and six feet in places, even though the outside row of holes was shot as light as possible.

All of this excess rock was used either to fill up holes along the side of the road, or to overrun the fills into the next balances, replacing the earth and using the latter to backfill the rock fills. The high fills were widened two feet on each shoulder, and what rock remained was broken up and stored on the side for future maintenance of shoulders on this project.

PARALLEL ROAD FOR LOCAL TRAFFIC

Making a connection for the people living on the bluff north of the highway, where it cuts through Bogg's Hill, presented a problem. The original project had approaches cut at right angles to the highway in order to take care of this traffic; but, owing to the depth of cut and lack of sight distance, it was found advisable to build a parallel road on top of the hill at the side of the cut, using a maximum grade of 10 per cent and making connection with the highway at the zero points of the grade of the main road. This side road is approximately 850 feet long, of gravel construction, with short radius curves and a guard rail next to the main highway. The excavation from this side road is being used for backfill in the rock cut which eliminates a long haul and the expense of securing a borrow pit for this material.

SECTIONS B AND C

Practically the same scheme for excavating was used in the rock cut on Section B, with the exception that mules instead of a hoist were used to return the empty cars. A layer of loose rock, from two feet to four feet in thickness lying on top of the ledge rock, reduced the



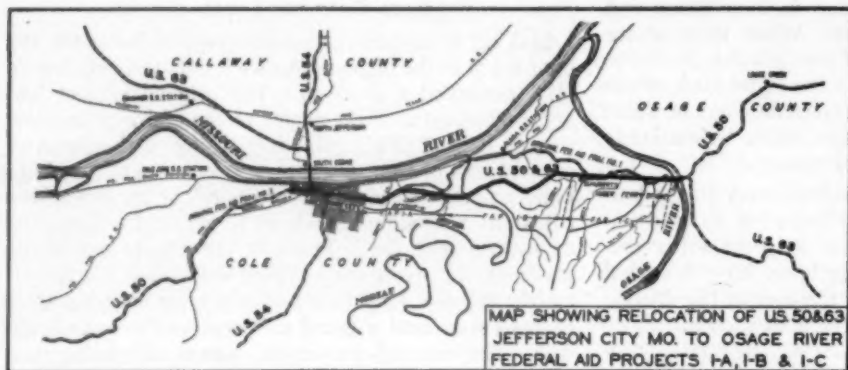
Sullivan Compressed Air Drill Sharpener by Which the Efficiency of the Rock Work Has Been Materially Increased

efficiency of the elevating graders to such an extent that it was not practicable to use them in this material, and hence a shovel was used to take out the loose rock before drilling the solid ledge.

On Section C a similar condition was encountered. Dump wagons were used both in rock and earth work to haul from the steam shovel, and the material placed by use of a bulldozer attached to a Caterpillar tractor. This method of handling the work on this section, using bottom dump wagons, allowed the teams at all times to have a smooth roadway to travel over. The material was pushed over the end and sides by the bulldozer, and at the same time the continued forward and backward motion of the bulldozer packed the fill as it was built up in approximately two-foot layers.

LONG HAULS

Another peculiar feature of the entire job is the extremely long hauls of the excavation. Most grading jobs have a sufficient number of short haul cuts to enable the contractor to arrange his outfits so that part of his work is in short haul and part in long haul cuts,



thereby reducing the number of teams; but all of these hauls are extremely long and require a great many wagons to keep the machines moving efficiently.

The elevating graders were used in stripping the earth from loose rock cuts and in the borrow pits, of which the largest contained 39,200 cubic yards and was approximately 1,000 feet long. In all cases these pits were immediately adjacent to the fill. The average outfit working in the cuts and borrow pits consisted of twelve wagons and teams.

CULVERT AND BRIDGE WORK

Culvert and bridge work on the three sections was started early and so was kept ahead of the grading operations. Due to extreme high-water, the large bridge in Section B over the Moreau River, however, was not completed ahead of the grading; although the two abutments were placed and fills constructed to them. This bridge consists of steel span of 180 feet and 6 concrete deck girder approach spans having a total length of 246 feet 9 inches. This crossing over the Moreau River is only one mile above its confluence with the Missouri River; and, as the Missouri River has been at flood stage practically the entire spring and summer, considerable difficulty from backwater has been encountered in the foundation work for this bridge. During October, 1927, the water was 12 feet above low-water stage. There was an average depth of approximately 45 feet from low-water to bed rock at this location, and some very unstable material has been encountered in the sinking of the river pier. The design calls for the piers to rest upon piles, the base of the piers to be approximately 24 feet below low-water. The bridge work also includes a deck girder span of 50 feet over Rising Creek in Section B and a 50-foot deck girder span over Sanford Creek in Section C.

COMPLETION IN 1928

The completion date is March 29, 1928, and it was planned to let an 18-foot concrete slab during the winter of 1927 for construction during 1928. At this writing the grading is approximately 66 per cent complete, the bridges 49 per cent complete, and the culverts 100 per cent complete. The work should be finished by the completion date with the possible exception of the Moreau River bridge. The work is being done under the supervision of the Missouri State Highway Department, T. H. Cutler, Chief Engineer; Ray Dunlap, Engineer of Construction; R. W. Hodson, Engineer of Division No. 5; W. O. Hill, Engineer of Construction

of Division No. 5, and Marcus Sagal, Project Engineer. Being Federal aid projects the work is also under the general supervision of W. H. Lynch, District Engineer of the United States Bureau of Public Roads at Omaha, Nebraska, and H. H. Lotter, Senior Highway Engineer of the United States Bureau of Public Roads at Jefferson City, Missouri.

Rock Crushing Costs Reduced

ROCK crushing costs have been greatly reduced at the plant of the Byers Crushed Rock Co., Kansas City, Mo. A 180-horsepower Fairbanks, Morse diesel engine was installed at this plant fifteen months ago and figures show that the power cost per yard of rock, crushed and elevated, was reduced from 7 cents with a purchased power to 1-1/3 cents with the engine. This showing was made even with the delivered cost of fuel oil at 6 cents per gallon, due to the fact that the plant is approximately four miles from the nearest railroad siding, and includes the operation of the air compressor.

When this diesel engine was installed, the quarters of the engine room were rather cramped, so the 10x11-inch Sullivan air compressor was direct connected to the engine stub shaft with an intervening pulley for driving the elevator, crusher and screen. A small, 32-volt generator was also hooked up to the 3-horsepower "Z" engine, which drives the starting-air compressor so that the plant could be entirely free from purchased current.

The diesel engine is equipped with a Midwest filter to insure clean scavenging air. Treated water is used in an enclosed circulating system for cooling the engine. The water is pumped through a series of coils and the raw water for cooling the enclosed system is from a creek. The engine has been in operation fifteen months and during that period there have been no major repairs necessary, the total repair bill being 82 cents. Figures for the month of July, 1927, show the amount of rock crushed, 6714 yards; fuel consumed, 1200 gallons; and lubricating oil consumed, 40 gallons.

The Byers Co. operates eight 5-ton White trucks, which are kept busy throughout the day. The diesel not only furnishes power to the crusher which consists of 7½ K gates and No. 36 Symon disc and the Sullivan air compressor, but also an 84-foot elevator using 24-inch buckets and one 24x48-inch screen.

The installation has reduced costs to such an extent that the company is able to make a price on contract jobs that has enabled it to take the business that was formerly held by competitors. It is one of the few crushing plants which has operated full time throughout the last year in the vicinity of Kansas City. In addition to the actual reduction in operating costs, the plant has eliminated the frequent shut downs during electrical storms which threw the whole plant out of work and cost the company considerable in time and payroll expense.

Louis Marino, one of the partners in the organization, operates the engine himself in connection with his other duties consisting of superintendence of blasting, care of two jack hammers, excavation and other duties necessary to the operation of the plant. He says:



The Byers Crushed Rock Co. Turns Out Some 7,000 Cubic Yards of Crushed Rock Per Month and Uses Eight 5-Ton Trucks for Distributing the Product to the Trade. The View on the Right Shows the 180 HP. F-M Diesel Which Not Only Drives the Crusher and an 84-Ft. Elevator and Screen, But Is Also Direct-Connected to a 10 by 11-In. Sullivan Air Compressor

"Our crusher has never been down for lack of power; in fact, we consider the diesel engine more dependable than electric current which we formerly operated with. Our record shows that it cost us more to operate the compressor alone on purchased current than it now costs to operate the entire plant."

Building Construction in the United States

BUILDINGS in the United States today have a total value of \$180,370,000,000, according to statistics recently compiled by the Copper and Brass Research Association in its annual survey of the building industry. Construction in 1928 will total almost ten billions. This estimate includes new buildings and repairs and maintenance to existing structures. Expenditures in 1927 on the same basis approximated \$9,775,000,000. The survey discusses in detail the value of all construction, appreciation in worth of buildings, distribution of buildings by classes, building in 1927 and 1928, and geographical distribution.

VALUE OF ALL CONSTRUCTION

The report states, "In considering the value of all classes of existing buildings and attempting to derive figures which are even approximately correct, the most baffling problems are those of depreciation, appreciation and repairs and maintenance. Last year's survey set the value of all types of construction at \$175,414,000,000 on January 1, 1927. Starting with this figure, we can estimate as follows:

	Billions of Dollars
Value of all types, January 1, 1927	\$175.41
Add new construction in 1927	5.73
Less a fire and storm loss of	.62
Leaving a net increase of	5.11
This gives a total of	180.52
Depreciation during the year is determined as follows:	
100.2 billions (56.1% of the total of 175.4) of residential construction has a probable useful life of 30 years. The annual rate of depreciation is 3-1/3%, and the money value is	3.34
75.2 billions of other construction is estimated at 40 years with an annual depreciation rate of 2 1/4%, or in dollars	1.88
To this add depreciation on the net new construction in 1927, which has an average rate of 2.61%; in dollars this is	.07
The total depreciation charge is then	5.29
Leaving a net worth of	175.23

To this amount must be added the appreciation value of buildings and the amount spent for repairs and maintenance. The former figure is probably more than 1.09. Repairs and maintenance (using last year's figures) cost. 4.05

The Grand Total is \$180.37

This is an increase during 1927 of 4.96 billions, or 2.83 per cent. During the same period the population increase is variously computed as from 1.18 per cent to 1.91 per cent.

DISTRIBUTION OF BUILDING BY CLASSES

Careful analyses of seven different authorities give the following percentages for various classes of buildings, according to the Copper and Brass Research Association. They represent as true a picture of such classification as can be prepared:

Class	Per Cent	Amount
Commercial	16.2	\$29,220,000,000
Hospitals	2.9	5,230,000,000
Hotels	5.1	9,200,000,000
Housings	51.1	92,170,000,000
Industrial	6.8	12,260,000,000
Public	2.9	5,230,000,000
Recreational	5.4	9,740,000,000
Religious	2.7	4,870,000,000
Schools	6.9	12,450,000,000
Totals	100.0	\$180,370,000,000

BUILDING IN 1928

For the coming year the following is an estimate of the money to be expended:

For new construction—housings	\$2,380,000,000
For new construction—other	2,400,000,000
Fire and storm losses	\$90,000,000
Repair and maintenance	4,120,000,000
Total	9,690,000,000

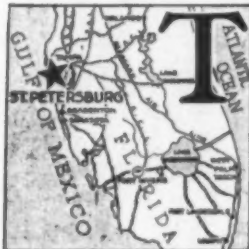
"It is apparent that," according to the Association, "so long as the financial condition of the country remains favorable, there must be spent annually a sum approximating ten billion dollars. The population increases about 1,600,000 per annum. With five persons to the house, more than 300,000 homes must be constructed to provide shelter for the newcomers. The amount set forth above is little enough for this huge number.

"Revised estimates show for the past year a slight increase in the ratio of dollars spent on housings to dollars spent on other classes. This is now 1.09 as compared with 1.05 for 1926. An increased sum will be spent yearly for repairs and maintenance. An average of 2.6 per cent of the total worth is probably an underestimate, yet it amounts to over \$4,000,000,000 a year."

Brick Streets of St. Petersburg, Fla.

By Y. Briddell

Superintendent, Georgia Engineering Co., St. Petersburg, Fla.



THE first brick street in St. Petersburg, Florida, was laid twenty-four years ago, July, 1904, on Central Avenue from Second Street to Fourth Street. This street has the original brick, and little or no repairs have been made. In the construction of this street, no base was used and the sand foundation was only graded to

the required depth. This foundation was thoroughly wet and rolled with a 5-ton roller, then the brick were laid on edge and a sand filler swept into the interstices.

Our organization laid its first brick in St. Petersburg in 1910, on Central Avenue from Sixth to Ninth Streets. Only a few of the streets of St. Petersburg have brick laid on edge and over 99 per cent is laid flat. Since the first brick streets were laid in 1904, the city has increased its yardage year by year until 1924, when a large contract for 500,000 yards of brick paving was let, followed by a still larger one in 1925, when 900,000 square yards were awarded.

The streets range in width from 27 to 70 feet, and the alleys from 10 to 20 feet. All of the 150 alleys are paved with brick of No. 2 quality.

Out of 213 miles of brick streets here, 80 per cent is constructed on sand base with sand filler, the other 20 per cent on a 6-inch shell base with asphalt filler. Three forms of construction are used: brick laid flat on a sand foundation with sand filler; brick laid on a shell base with sand filler; and brick laid on a shell base with asphalt filler.

SAND BASE CONSTRUCTION

The foundation is graded out to the required depth, grade being established by the City Engineering Department, after which the foundation is flooded with water until thoroughly settled, and a 5- to 7-ton roller is used, rolling back and forth until the grade is thoroughly compact. This is leveled off with a template or hand lute to conform to the grade and the brick are laid flat on this bed of native sand. As soon as laid, the brick are inspected for defective and broken brick which are pulled and replaced with good brick. Then the brick are rolled with a 5-ton tandem roller. The brick is first rolled straight and then at an angle of 45 degrees each way. After the angle rolling, the brick which the roller has broken are removed and good brick substituted and hand tamped to a smooth surface. Sanding next takes place. The sand is swept between the interstices of the brick until well filled and the street is ready for traffic.

BRICK LAID FLAT ON SHELL BASE

The grading for brick to be laid flat on a shell base is the same as for sand foundation construction, with

the exception that the grade is cut out to a depth of 6 inches more than the sand base, to allow for the shell base. The shell base usually has a depth of 6 inches and is put down in two layers, each layer being rolled with a 7-ton tandem roller until well compacted. This shell will compact about one-third in rolling and in some cases more where the shell used is washed. After finishing the shell base, a sand cushion 1 inch in depth is spread over the shell and leveled to the required grade. Upon this cushion the brick are laid flat in straight lines, followed by inspection and rolling described above, with the exception that in place of sand filler, asphalt is used.

When asphalt filler is used, the asphalt is heated to not over 350 degrees F., and poured over the surface of the brick. The joints are filled by squeegeeing. The squeegee is on the order of a window wiper with a long handle and a long blade at the end, with rubber belting fastened to it. This spreads the asphalt to a smooth surface, and fills the interstices to the surface of the pavement. The sanding takes place over the asphalt filled brick and the pavement is then thrown open to the public.

SAND BASE AND SAND FILLER

Where a sand base and sand filler are used, the construction is the same as described above, except that a sand filler is used instead of the asphalt filler.

GRANITE CURBING

Georgia granite curbing is used almost exclusively in St. Petersburg, as it has been found more satisfactory than other forms of curbing, because it can be removed and reset when widening takes place. This is being done every day as the city is growing and wider streets are necessary in the downtown district and other heavy traffic sections. The specifications for granite curb require that the granite curbing shall be 4 inches thick, not less than 14 inches in depth for pavements having sand foundations and not less than 18 inches in depth for pavements having shell foundation, and not less than 4 nor more than 8 feet in length except for closures which shall be not less than 3 feet in length. All radius curb is of 9- and 15-foot radius, 15-foot radius being used at the intersections of streets, and 9-foot radius being used at all alleys.

HEADERS

At all street intersections and at ends of paving where there are no abutting hard pavements, headers of stone not less than 3½ inches wide and not less than 12 inches deep flush with pavement or counter-sunk, not to exceed 3 inches, if adjoining a soft pavement, are used.

BRICK SPECIFICATIONS

Specifications for No. 1 brick require that they shall be evenly burned, thoroughly annealed, regular in size and shape, and when broken shall show uniformity of

texture and structure and free from lime, air pockets, cracks and open or marked laminations. They must not be fire-flashed, smoked or treated in any manner tending to give artificially a uniform color outside. Kiln marks must not exceed $3/16$ th inch, and on one side at least show but slight kiln marks. In the rattler test, the brick shall not lose more than 26 per cent and ten brick are used in a single test.

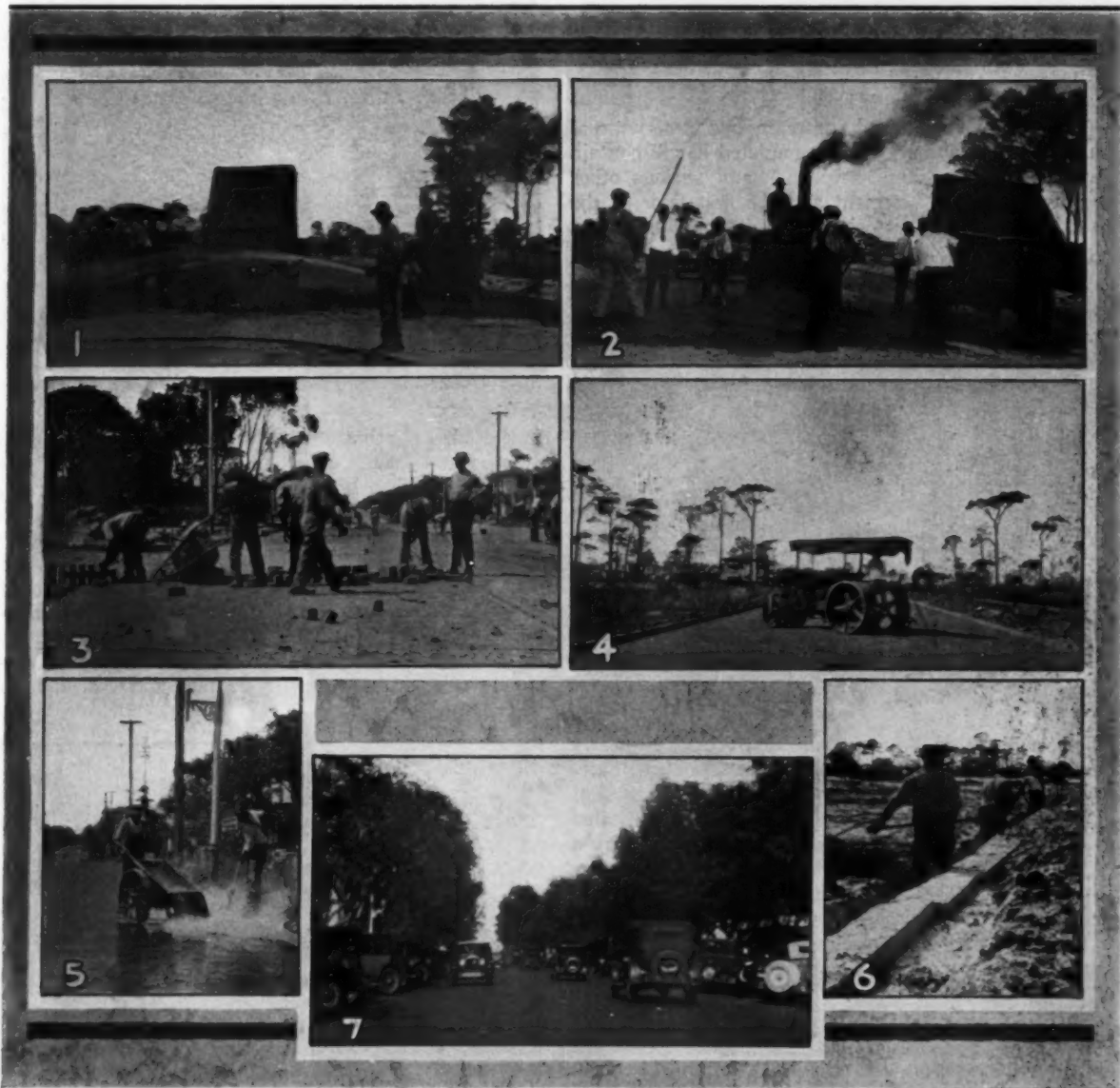
PAVING BY PETITION

When a street is to be paved, the property owners of the street present a petition to the city commissioners, signed by owners of two-thirds of the property feet on this street. After being passed by the commissioners, bids are advertised for thirty days and award made to the lowest bidder. The property owners pay for all

improvements on the street including the advertisement for bids, intersections and engineering costs. After the street is completed and estimated, notices of the amount of the individual assessments are sent out to each property owner and he has the option of paying cash or over a period of five years. Paving certificates of the time plan are a first lien on the property.

AMOUNT OF PAVING

St. Petersburg has a total of 284 miles of streets of various widths, with an average width of 27 feet. Of this amount 213 miles are of vitrified brick and 71 miles of asphalt block. Three-inch repressed vitrified brick have been used on most of the work except on the last contract where $2\frac{1}{2}$ -inch vertical fibre brick were specified.



BRICK PAVING IN ST. PETERSBURG, FLA.

1. Wetting the grade ahead of the shell base. 2. Spreading and rolling the shell base. 3. Laying the 3-inch repressed vitrified brick. 4. Final rolling of the brick at an angle before applying sand or asphalt filler. 5. Pouring hot asphalt on brick and spreading with squeegee. 6. Setting the granite curb. 7. A completed street of brick with asphalt filler.

Building a World War Memorial

By W. G. Miller

Consulting Engineer, Indianapolis, Ind.



CONSTRUCTION of the World War Memorial at Indianapolis, Ind., was begun in March, 1926. The completion date has been set for August, 1928, all work being completed to date with the exception of the roof, which will be of stone. The Memorial is 210 feet high, the outside dimensions are 250 x 250 feet at the base.

The structure will cost approximately \$2,500,000. The walls are of the best buff Bedford, Indiana, limestone quarried, backed up with brick.

The Shrine or main building represents some unusual building construction. When completed it will contain an auditorium seating 500 people, and various other rooms in the first basement and the first floor of the base. The Indiana Historical Commission will have its



Photo by Bretzman

Bottom Footing of the Foundation for Building "A" or the Main Structure of the Indiana War Memorial

offices, a historical library, exhibition room and nearly one-half mile of wall space in the first floor and basement corridors for the display of battle flags, now kept at the State House. An imposing shrine room dedicated to the flag will be located above the first floor, with a ceiling 100 feet high. An elevator will reach nearly to the top of the building. Each of the 24 stone columns used in the building weighs 65 tons.

The site of the Memorial is between Meridian and Pennsylvania Streets. It extends from Vermont Street or the north side of University Park to St. Clair Street or the Riley Memorial Library and comprises three city blocks in length.

On the first block, or between Vermont and Michigan Streets, is Building "A," which is described in this article. On the second block, or between Michigan and North Streets, an obelisk 90 feet high will rise from the center of this block of park development. The third block, or between North and St. Clair Streets, will be used mostly for a park. There will be two buildings

erected on the north end of this block on the street line of Meridian and Pennsylvania Streets.

FOUNDATIONS

The specifications and supervision for the foundation work were exceedingly rigid. The bottom footing, 130 x 130 feet, contains 1076 cubic yards of concrete alone. A mix of 1 part cement, 2 parts sand and 4 parts gravel



Photo by Bretzman

Steel Grillage in the Foundation Ready to Be Encased in Concrete

was used. The bottom footing required a continuous pour so as to make a perfect bond on all parts of the foundation. Two Boss American Cement Machine Co. concrete mixers of 2-bag capacity were used, one on each side of the construction work. The work of pouring this 1076 cubic yards was completed in 62 hours of continuous work. Figures show that 1452 batches of concrete were poured in 3720 minutes by the two mixers. Insley concrete chutes greatly facilitated the placing of the concrete. One-inch and 5/8-inch round Truscon reinforcing steel bars were laid and spaced both ways.

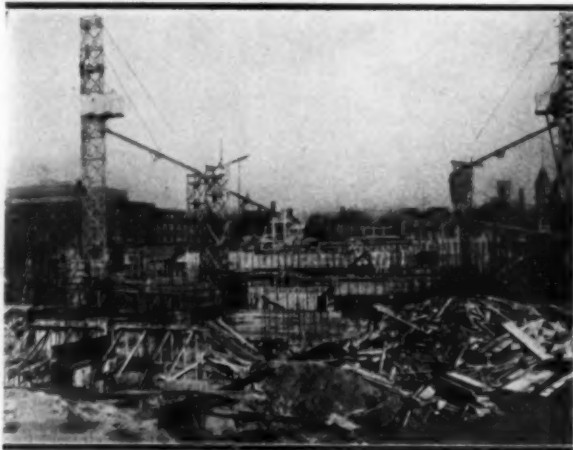


Photo by Bretzman

Concrete Forms and Reinforcing Steel Bars in Place and Concrete Pouring Under Way from Wooden Towers

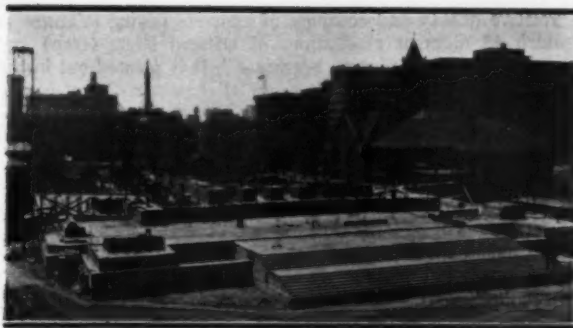


Photo by Bretzman

Foundation Completed, Showing the Concrete Steps Which Were Built as a Part of the Foundation

Steel grillage composed of 28 pieces of 42-inch Insley steel girders 50 feet long was laid on the bottom footing. The entire weight of this grillage was 1089 tons, and it was designed to carry the entire load of the main structure.

The concrete forms and reinforcing steel bars were placed immediately on top of the steel grillage, and

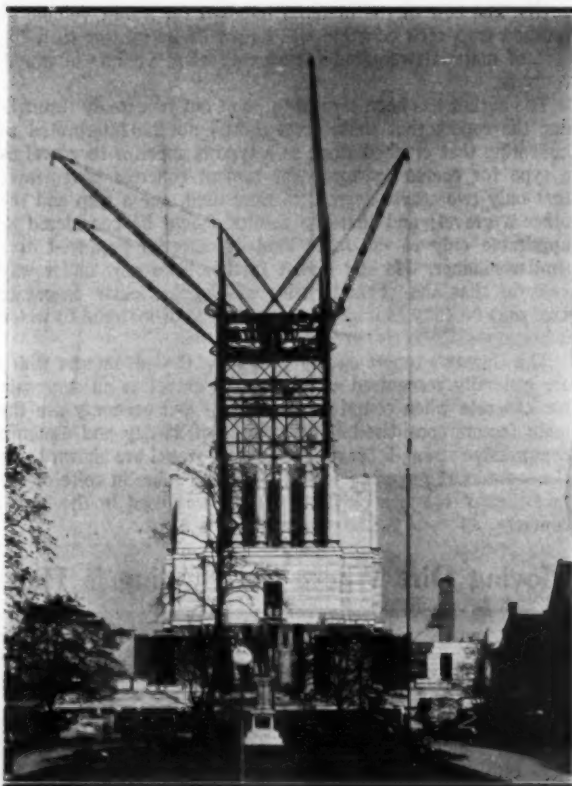


Photo by Bass Photo Co.

The 200-Foot Structural Steel Tower with Four American-Terry Steel Stiff Leg Derricks Used for Erection Purposes

form the more complicated design of the foundation construction, since the distribution of concrete into forms where it is necessary to have reinforcing steel bars at certain definite and exact spacing makes the problem of labor saving equipment a very important item. This was accomplished by the construction of wooden towers by the contractor, the E. C. Strathman Co., of Indian-

apolis, and buckets were used as elevators. With the spouts, the concrete could be placed in any part of the work where it was needed.

The form work on the upper part of this construction was particularly complicated, there being 425 tons of



Photo by Bass Photo Co.

Brick Construction Finished on Top of Concrete Foundation. The First Part of the Indiana Limestone Work Is Shown as Well as the Start of the Steel Erection Tower

1-inch and $\frac{5}{8}$ -inch reinforcing steel bars and 11,000 cubic yards of concrete used in the entire foundation construction. The concrete steps of the Memorial were constructed as part of the foundation.

SUPERSTRUCTURE

Construction of the superstructure on top of the con-



Photo by Bass Photo Co.

The Indiana World War Memorial Nearly Completed with the Exception of the Stone Roof

crete foundation was begun in May, 1927. Steel towers were erected on each side of the work, and a 200-foot structural steel tower was erected by the Central States Bridge and Structural Steel Co. At each corner on the top of this tower was an American-Terry steel stiff-leg derrick. The booms were 100 feet in length and were equipped with Bull wheels. Four 65-horsepower Thomas electric hoist engines were used to operate the 4 steel derricks. These were placed on the main floor.

The steel framework which must be demolished before the building can be completed cost approximately \$40,000. The huge stones for the tower will be lifted to the top before the framework and crane are removed. Then a boom will be constructed through the top of the open space left for the platform and the stone lifted into place by the boom.

CONSTRUCTION DATA

Stone shaft	90 x 90 ft.
	210 ft. high
Structural steel	1089 tons
Reinforcing steel bars ..	435 tons
Concrete	11,000 cubic yards
Brick	6,100,000
Bedford limestone	110,000 cubic feet
Granite	25,000 cubic feet

ORGANIZATION

The foundations of this Memorial were constructed by the E. C. Strathman Co. of Indianapolis, Ind., with M. E. Tultz, Superintendent of Construction. Hunkin-Conkey Co., of Cleveland, Ohio, had the contract for the construction of the superstructure. Walker & Weeks of Cleveland were the architects.

Comparative Tests of Crushed Stone and Gravel Concrete

THE comparative tests of crushed stone and gravel concrete described by F. H. Jackson, Engineer of Tests, Division of Tests, U. S. Bureau of Public Roads in a recent issue of *Public Roads* give results of flexure, compressive and yield tests of concrete for thirteen different gradings of gravel and of crushed trap rock each from a single source. One of the principal reasons leading up to the tests was the claim of crushed stone interests in New Jersey that under existing conditions of specifying the same proportions of cement and aggregate for concrete regardless of the void content of the aggregate, "concrete produced from crushed stone is of a better quality than that produced from gravel due to the difference in character of these two aggregate, and to the higher cement content of the stone concrete as expressed in terms of volume of cement required to produce a unit volume of concrete."

With the view of obtaining data which would furnish information as to the truth of this claim the Bureau of Public Roads in cooperation with the New Jersey State Highway Commission carried out a laboratory investigation to determine the following:

1. The relative strength and yield of crushed stone and gravel concrete of the same proportions and consistency and with the same size and grading of coarse aggregate.
2. What grading of coarse aggregate and what proportions of fine to coarse would give the greatest yield for each type of aggregate when the concrete is designed for a given strength.

The expressed purpose of the tests was to determine the

"relative quality and economy of concrete paving mixtures in which 13 different gradations of crushed stone (trap) and gravel were used as coarse aggregate." It is pointed out in the report that "in discussing the essential characteristics of paving concrete, it is herein assumed that insofar as strength is concerned resistance to bending or flexure is of more importance than is resistance to crushing."

Both the gravel and crushed trap rock aggregate, each from a single source, were of satisfactory quality. The gravel was a good grade of material with physical characteristics well within the original specification limits. The crushed rock was a very hard, tough and dense grade of stone.

The principal conclusions drawn from the tests by F. H. Jackson, author of the article, are:

1. That when coarse aggregates comparable in quality to those used in these tests are employed in the construction of concrete pavements in New Jersey under existing specifications:

(a) Concrete in which crushed trap rock is used as coarse aggregate will average about 12 per cent higher in flexural strength than concrete in which gravel is used as coarse aggregate.

(b) There will be practically no difference in the crushing strength of trap rock concrete and gravel concrete.

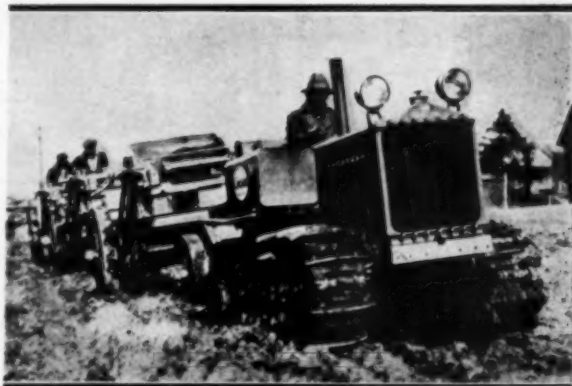
(c) For equivalent flexural strength slabs, a pavement constructed of gravel concrete should have a depth of approximately one-half inch greater than a pavement constructed of crushed trap rock concrete.

(d) The cost of the material required for a unit volume of crushed trap rock concrete will as a rule be greater than the cost of materials required for an equivalent volume of gravel concrete.

The author has been careful to point out repeatedly throughout the report that these tests should not be interpreted as indicating that crushed stone as a type is superior to gravel as a type for coarse aggregate for cement concrete pavements; that only two coarse aggregates were used, one a trap and the other a gravel; and that the results should be considered as applicable only to the same kind of material produced in a similar manner. He states that further tests now under way indicate that the characteristics of the particular aggregate used may be fully as important as the type of material to which it belongs.

The Bureau's report clearly points out the advantages which are generally recognized as inherent to gravel as an aggregate for concrete when compressive strength and economy are the main factors considered. The average of 28-day and 6-month compressive strength for all gradings of gravel are shown to be the same as the average for all grades of stone in spite of the fact that 6 to 7 per cent less cement was used in the gravel concrete.

Moving Dirt Where the Hauling is Hard



A Cletrac Hauling Three 1¼-yard Baker-Maney Wheel Scrapers, Owned by L. L. Clymer, Bluffton, Ohio, on a 21-mile Road Job



Thew Backdigger Digging Trench for Hot Water Pipe

Pipe Laying Under Water

THE Edgewater Plant of the Ohio Public Service Co., located on the shore of Lake Erie in Lorain, Ohio, recently completed an unusual job in an unusual way. For eight years the Ohio Public Service Co. has given practically uninterrupted power service to northwestern Ohio. The only exceptions were two shutdowns caused in the winter months by needle ice forming in the intake channels from which water is drawn for their condensers.

This plant is capable of developing 22,000 horsepower. It has a 20,000-kilowatt main turbine and an 8,000-kilowatt reserve turbine. It requires 45,000 gallons of water per minute for their condenser. This water is taken from Lake Erie through a 30-foot wide channel which runs from the screening house 710 feet out in the lake. The channel is formed by two parallel piers. The east pier supports a railroad track on which a locomotive crane operates to remove the sand which continually washes in during storms, and to maintain the necessary depth of 11 feet.

At certain periods during the winter, needle ice forms on the surface of this channel and gets into the cylinder screens and condensers, interfering with the flow of water.

For several years this trouble was overcome by digging a trench by hand for water to flow from the hot water outlet to the inlet channel, thereby heating the water sufficiently to prevent needle ice.

It is not desirable to heat this water to any great extent as the highest efficiency of the condensers is secured when the water is coldest; in fact, the most favorable condition is when the surface of the lake and channel is covered with cake ice.



The Backdigger Setting 48-inch Concrete Sewer Pipe

This hand-dug channel, however, was a rather crude and impractical remedy, so it was decided to make a permanent water conduit by laying a 48-inch sewer pipe cross-over line from the outlet to the intake. The new course of this type conduit must lay mostly under water and about 18 feet from the dock, which is 10 feet high.

Altogether, there were 512 feet of pipe to be laid. How to dig a trench under water in shifting sand, lay and cement the pipe and cover it again, was quite a problem but Trifiletti Bros., who secured the contract, were equal to the job. Their method was ingenious. Sam Trifiletti, who personally superintended the work, selected a Thew backdigger for the job rather than the clamshell machine which would ordinarily have been used. The backdigger remained on the dock and from that position dug the trench, set the pipe, backfilled and even drove the necessary piling.

First, the backdigger, which has a digging reach of 37 feet, 8 inches, scooped out a hole big enough for about two lengths of pipe. Then it swung around and picked up a pipe section by means of a pipe hook, lowered it into place and held it exactly where wanted until blocked and tamped. This pipe was double-ring reinforced concrete $5\frac{1}{2}$ inches thick, 48 inches in diameter, 4 feet long and weighed 1900 pounds.



A 45-degree Bend Made Without the Use of Angle Joints

Two men with shoulder-high wading boots cemented the pipe on the inside at the bottom and on the outside at the top. Strips of cement bags were laid over the fresh cement to protect it from the wash of the water and from disturbance during the backfilling operation. After each section was placed, the machine backfilled before its position was shifted.

While there were no angle joints used, a 45-degree bend was effected by making a wide sweeping curve around a corner.

At the hot water outlet from the plant, there was a box constructed of open piling which by slightly stopping the flow of water raised its level about 10 inches. This gave sufficient head to force the water to flow through the conduit and permitted sufficient cold water to mix with the hot so that its heating effect on the intake water would not be too marked.

The piling for this box and along the outside of the pipe where necessary, was all driven by the backdigger boom and bucket, with a railroad tie chained to the bottom of the bucket.

The tilting bucket of the backdigger enabled the operator to control the position of the tie at any distance from the machine, which could not have been possible with a stationary dipper type.

Where the hot water cross-over line cut into the intake channel through the original piling, the cut was made and a gate placed by a diver with a deep sea diving outfit. This gate was made of two-by-fours bolted together. The gate slides in grooves of channel iron and is 5 feet square, raised by means of a small windlass.

Mr. Trifiletti used only five men and the backdigger for the job.



A View of the Sluceway and Trenches on the Big Blue Slide Near Garberville, Calif.

Educated Landslides

AN "educated landslide" is one of the recent achievements of California, according to a recent article in *California Highways and Public Works*. In Humboldt County, District Engineer T. A. Bedford of the State Department of Public Works, is training landslides in the way they should go instead of allowing them to clutter up the highways and block traffic to the great inconvenience of travel and the greater disgust of the engineer. The methods employed



A Portion of the 300-Acres of Disintegrating Shale, Blue Mud and Boulders Representing Probably 500,000 Yards of Unstable Material Slowly Moving Down on to the Highway

by Mr. Bedford are of considerable interest and may be applied elsewhere by contractors.

Mr. Bedford does not claim that he has 100 per cent obedience from the landslides—yet, but at least he can say that he is schooling them in a greater sense of the proprieties than they have shown in the past. It should be mentioned in passing that the pioneers who first devised hydraulic mining, pointed out the way that has been followed in schooling these landslides in better manners.

The Big Blue Slide in Humboldt County so completely covered a portion of the State Highway that in places not even an appearance of the highway was left. The slide area is one-third of a mile long, a quarter of a mile wide and 400 feet high. The material is a disintegrating blue shale marked with many cracks and fissures. It is estimated that there will be 200,000 cubic yards of this material to move in the next few years and it was up to the district engineer to find some way of moving it cheaply.

HYDRAULIC GIANTS

A 4-inch pipe line was brought from Fish Creek with a 200-

foot fall and half a mile distance from the slide. Two deep trenches were sluiced into the mountain side and so arranged that they converge into a sluceway. The trenches catch the slide as it comes down the mountain side and carry the material into the sluceway, a 6 x 5-foot box with a lip on the upper end. These trenches also drain the water out of the slide.

The sluceway was built on a 1 to 4 slope, but Mr. Bedford recommends a 1 to 3 slope so that the slide will automatically dispose of itself without sluicing.

In the operations at the Big Blue Slide, two men were employed rolling the bigger rocks into a sump which would hold several yards of material. The rush of water and mud carried these big rocks through. Three men moved 300 cubic yards of material per day at a total cost of 10 cents per cubic yard.



The Highway After a Severe Storm Showing How Effectively the Slide Stops Traffic

This was distributed as follows: wages 4 cents, transportation 1 cent, sluceways 2 cents, installation 1 cent, supervision, etc., 1 cent, delays 1 cent.

District Engineer Bedford reports that when the trenches are dug and the slides "trained" to follow them, very little care is necessary. Last winter 25,000 cubic yards of material went through one of these sluceways with very little attention due to the heavy rains.

SANDS BLUFFS REMOVED

The hydraulic method of slide removal is also being used on the sand bluffs near Trinidad in Humboldt County. Thus far about 35,000 cubic yards of material has been used at this point at an average cost of 8 cents a cubic yard. It is



Monitor at Work Putting a Slide Through the Sluceway with the Assistance of Two Men Working in the Sump Rolling Boulders into Place

estimated that there are about 150,000 cubic yards of material there yet to move. In ideal conditions and a loose soil, this work can be done at 5 cents a yard, but where the sand and gravel have been more or less cemented, it costs 15 cents a yard. The water was brought from a creek about 2000 feet away by a single stage centrifugal booster pump driven by a Cadillac motor. It was pumped through 1000 feet of 5- and 4-inch pipe and raised 70 feet. It was then picked up by a 5-stage centrifugal pump and raised 90 feet through 1000 feet of 4-inch pipe. About 2000 gallons of water per minute were delivered. With two pump runners and two nozzle men from 1000 to 1200 yards was moved per day at an average cost of 8 cents a yard. This material was easily carried in suspension through a flume laid on a 10 per cent grade to the ocean below.

Where water is available, it is planned to do considerable road widening through the sand bluffs by this method. More powerful pumping plants delivering a larger volume of water under higher pressure will move the dirt still cheaper.

Separate Sizes of Coarse Aggregate for Concrete

THE subject of separating coarse aggregate into several sizes for the manufacture of concrete is of extreme importance and is rapidly attracting more and more attention. The need for this refinement in the manufacture of concrete is not, as some seem to believe, from the fact that the quarries do not produce and ship the proper sizes to give the desired gradation. The need arises from the segregation which takes place in the handling of the material after it leaves the quarry and before it enters the concrete mixer.

SEGREGATION

A few examples of this segregation and how it occurs will illustrate the point: On a large construction job the materials were assembled before the actual concreting started. The contractor installed modern equipment to control the cement, the sand and the water. The coarse aggregate had been stored adjacent to the proportioning plant in one large stock pile. As is inevitable in such cases, the coarser particles remained on the outside of the pile, while the core contained the small particles. When a batch containing the coarse particles was mixed, the consistency of the concrete was of such a wet nature that the sand and cement would run away from the coarse aggregate. On the other hand, when a batch containing mostly small particles was mixed, the concrete was of such a dry, mealy consistency that in some cases it was practically impossible to get the batch out of the mixer. By extreme vigilance on the part of the mixer operator, this condition was helped, but it was impossible to produce the highest class concrete under the circumstances. All the benefits which should have been derived from modern equipment were lost by the segregation of the coarse aggregate.

An experience on a road job several years ago will illustrate how segregation in its worst form can occur. The coarse aggregate actually entering the mixer might have been thought to have been separated into sizes due to the segregation which had taken place in the handling. Observation of the material at the producing plant, as it was loaded, showed the material to be satisfactorily graded as it entered the cars. Upon investigation, these were the conditions found: The material was loaded from the bin into the car by chutes with the usual small amount of segregation. All the cars, which were hopper bottom, were delivered on a trestle at the unloading point. The material flowed through the bottom of the cars to a bin under the trestle and from the bin into trucks to be hauled to a stock pile at the job. When this material entered the mixer, the segregation had so changed the appearance and utility of that material that it could hardly be recognized as the same material which had been loaded at the producing plant. While this is an unusual

case, it illustrates the point and gives a picture of what happens to a greater or less degree on every concrete job.

SHIPPING OF SEPARATE SIZES

Material may be rejected after it arrives on the job due to improper grading, and excessive dust. With stone shipped in three sizes, the possibilities of rejection from improper grading will be nil. Under present conditions, if three cars were shipped containing excessive dust, all three cars would be rejected, whereas if the same stone were shipped separated into three sizes, all the dust would most likely be in the car with the small stone, and that one car would be rejected.

LOCAL MATERIAL

Just recently there appeared an article showing the saving by designing a mix for the use of local material on a roadway job. This material did not meet the specifications, but by the addition of more cement the local material was used and a considerable saving was the result. The material was deficient in large size particles. Had separated aggregates been required in these specifications, the contractor could have used his local material and supplied the deficient sizes from commercial plants. By this method, specification material with no additional cement could have been used. The saving by combining the local material with the commercial material would have been as much, or more, than with the use of local material and additional cement. If this procedure had been followed, the commercial plants would have furnished approximately fifty percent of the coarse aggregate on this job, whereas under the procedure which was followed, the commercial producer lost the whole job.

There will at all times be the competition of local material. Wherever it is economical it should be used, but by the encouragement of separated sizes of coarse aggregate the deficiency will be filled by the addition of the proper sizes of aggregate instead of by the addition of more cement.

PREVENTING SEGREGATION

It might be well to consider some of the methods now in use to prevent segregation. California requires the coarse aggregate to be shipped in two sizes and definite amounts of each size measured before entering the mixer. Iowa has reduced the maximum size and requires that stock piles be built in layers and limits the height of the stock pile. Other States have done likewise and, while this no doubt helps the situation, it does not correct it.

NORTH CAROLINA EXPERIMENTS

The most satisfactory specification along this line is that used by the State of North Carolina for some special experimental jobs now under construction. The maximum size allowed in North Carolina is $2\frac{3}{4}$ inches. Unfortunately, it was not thought practical to allow a larger size for this particular work, as it was feared that some of the producers would have jobs under the special specifications and under the regular specifications at the same time. In such case, a maximum size of $2\frac{3}{4}$ inches for one specification and $2\frac{3}{4}$ inches or 3 inches for the other specification, could cause considerable trouble.

In spite of the fact that a 1:2:4 mix was regularly used for roadway concrete, it was felt that by using inundation to accurately control the fine aggregate and to separate the coarse aggregate into three sizes and measure each size, the mix could be increased to a 1:2:4.65 and a concrete of suitable workability secured. This has proved to be the case. The idea in resorting to such a specification was primarily economic, and unless a concrete equal in value to the concrete obtained under the 1:2:4 mix is obtained, there will be no economic advantage. Had the maximum size of the coarse aggregate in these special specifications been increased to $2\frac{3}{4}$ inches or 3 inches at the same time that the mix was changed from 1:2:4 to 1:2:4.65, it is possible that even a better quality concrete might have been secured than that of the old mix.

By increasing both the size and volume of the coarse aggregate, using the same cement and fine aggregate, the finess modulus of the aggregate is increased and a stronger flexural strength concrete should be secured. If the flexural strength will be increased by the increase in the finess modulus and at the same time a concrete be secured which will absorb less water, it is hardly conceivable that this idea and these principles will not be followed, though perhaps not in the exact form now being tried out.

Should this idea prove its merit, it seems reasonable to suppose that it will be included in other specifications. In this case, quarries will more than likely be asked to furnish stone to be measured in separate sizes.

There is no doubt but that a specification as outlined would cause some little disturbance in the operation of a quarry, but where once the necessary changes had been made, the benefits should greatly offset the temporary disturbance caused at the quarry. If the successful method can be found to use larger size coarse aggregate for roadway concrete, the aggregate producers will receive a larger benefit than any of the interested parties, except the general public.

The increase in the maximum size aggregate from $2\frac{1}{4}$ inches to 3 inches would increase the production a considerable amount with no additional crushing expense. It also would reduce the percent of screenings in relation to the output, and this material is as a rule the least desirable aggregate produced.

ACKNOWLEDGMENT.—From a paper presented before the National Crushed Stone Association at West Baden, Ind., by R. T. Giles, Chief Engineer, Concrete Control, Blaw-Knox Co., Pittsburgh, Pa.

Novel Type of Bridge Rebuilt Annually

AT Cannonball, N. D., where the road crosses Cannonball River, is located a very unique type of bridge across the river which derives its name from the fact that during the spring floods it picks up sandstone boulders and rolls them along the stream bed wearing them down to a spherical shape so that they resemble cannonballs. This structure would be subjected to bad jams when the ice breaks up



The Toll Bridge at Cannonball, N. D.

in the spring, so a removable type of construction is used and each fall the bridge is entirely removed to be replaced again in the spring after the ice goes out.

The type of structure selected is shown in the photograph. When it becomes necessary for a horsedrawn vehicle to cross the horses must be unhitched, the wagon pushed across by hand and the horses must either wade or swim the river. The bridge is a privately owned toll structure and a charge of 50 cents is made for an automobile or a horsedrawn vehicle to cross.

Construction Details of Black Base Pavement

ONE of the most important construction details in securing an asphaltic concrete base, commonly termed "black base," is to secure a good thoroughly compacted, well-drained subgrade. If the subgrade appears unduly spongy under a 10- or 12-ton, 3-wheel roller, this condition should be remedied, or else black base should not be considered for that part of the project. It goes without saying that the finished subgrade should conform closely to line, grade and cross-section.

The proper and uniform proportioning of the mix is important. With the triaxial diagram it is easy to get proper proportions giving a granular surface to which an asphaltic top will readily bond and interlock.

After the preparation of the subgrade and the proper and uniform proportioning of materials, perhaps the next most important construction detail is that of thorough mixing. The temperature at the mixing plant can be readily regulated by means of pyrometers and the temperature should not vary above or below a comparatively narrow range around 300 to 325 degrees.

Assurance that the mixing plant to be used is modern and in good condition should be made before a construction contract is awarded. It is almost impossible to get as good a quality of work with an old, worn-out, run-down and poorly maintained plant as with a plant in good mechanical condition.

In laying black base thorough compression with a 10- to 12-ton, 3-wheel roller is important. The rolling should be continued at least as long as further compression can be secured. Closely related to the matter of compression is the matter of adequately backing up the curbs and gutters against which the black base is laid. If the curbing is not adequately backfilled and supported, the lateral pressure due to thorough rolling with a heavy roller will move the curbs out of line.

The wearing surface should be applied to the base as soon as practicable after the base has been compacted and partially cooled. While traffic is sometimes permitted on black base prior to laying the top, this practice is not to be encouraged.

ACKNOWLEDGMENT: From a paper presented by Warren H. Booker, Consulting Engineer, Charlotte, N. C., at the Sixth Annual Asphalt Paving Conference, Atlanta, Ga.

"Certified by Centuries of Service" Wins \$5,000 Prize for Wood Slogan

THIS is the phrase which won the \$5,000 prize in the slogan-for-wood contest conducted by the National Lumber Manufacturers Association as part of its national trade extension campaign. The author of the prize-winning slogan is James E. Noble, Jr., of Sanatorium, Miss. Six other grand prizes, ranging from \$2,000 to \$500 in cash, and fifty state and territorial prizes of \$100 each also were awarded, totalling \$15,000 in all. Other slogans which won prizes include: "Wood: Use It; Nature Renews It;" "Use It—Nature Renews It;" "Wood Answers the Material Question;" "Build Better with Better Lumber;" and "There's a Wood for Every Material Problem." Approximately 400,000 slogans were received in the contest.



A Portable Gas Engine Welding Unit with Bell Hole Man Who Has Just Completed One of the Welds Preparatory to Moving on to the Next Joint

45-Mile High Pressure Pipe Line Electric Arc Welded

RECENTLY a 45-mile electric arc welded pipe line, 7 inches in diameter, was completed from Lamkin, La., to Hodge, La. This pipe line carries from 600 to 1000 pounds pressure. The line was welded by the Big Three Welding and Equipment Co., Houston, Texas.

The bids on this job were \$2.75 per joint for oxy-acetylene welding and \$1.25 per joint for electric arc welding. The country over which the line ran was very rugged and broken. There were hills, deep ravines, woodlands, and a river to be crossed. Five gas-engine driven stable arc welders made by the Lincoln Electric Co., Cleveland, Ohio, were used. In doing the work in the field, the welders operated as a team: that is, four men simultaneously welded four consecutive joints and then moved on. The lengths thus formed were joined together by a bell hole operator.

The line was built in 5-mile stages, each stage being finished and tested under hydrostatic or gas pressure before further pipe was laid. The joints were all made in two layers. A total of only 14 pin holes was found in 11,000 joints. On December 15, 1927, the pipe line was finished and in the ditch. From Lamkin to Hodge it had been tested and accepted and there only remained the work of covering. Two weeks later, when about 20 miles of the pipe lay still exposed in the trench, a northwest storm swept through Louisiana and the temperature dropped to 6 above zero. In spite of this severe contracting stress, there was no failure in the entire 20 miles.

Culvert Pipe Jacked Under Irrigation Canal

THE Donna irrigation project recently installed two 30-inch pipe lines under its main canal at Donna, Texas. One was for a storm sewer and the other for a secondary drainage canal. The importance of uninterrupted water service and of undisturbed canal banks was realized, so the jacking method of installation was employed.

Eight 20-foot lengths of 30-inch Armco corrugated pipe were selected for the required line. This diameter, while ample from the standpoint of capacity is smaller than is generally recommended for jacking, as it is rather difficult for a man to work inside a pipe of this size. In this case, however, the distance between the bottom of the pipe and the canal bottom was only 5 feet and it was thought advisable not to take up more than half of this by the diameter of the pipe.

The Armco jacking method is a tunneling and jacking method with the pipe serving the double purpose of a shield to protect the workmen during installation and a lining for the completed opening. Starting in an approach trench at one side of the embankment, men inside the pipe excavate a short distance ahead of the pipe which is then pushed ahead by means of jacks. This process continues until by alternate tunneling and jacking the entire pipe has been pushed into the embankment.

At Donna, approach trenches were first dug down to the flow line of the two pipes, about 9 feet below the surface of the ground, for both the drainage canal and the storm sewer. These trenches were about 5 feet wide, with practically vertical sides. Short pieces of 6 x 6-inch timbers were then imbedded crossways in the bottom of the trench and to these were spiked two long 3 x 8-inch lining timbers accurately located on the desired line and grade to guide the pipe to the embankment. The approach trench was kept dry by a pump operated day and night.

A backstop was provided consisting of a 12 x 12-inch timber set on end in the earth at the outer end of the trench and slightly above the level of the lining timbers. The first section of pipe was then rolled into place on the lining timbers and jacking begun.

To distribute the pressure of the jack evenly over the end of the pipe an 8 x 16-inch timber bearing block was used. Pressure was applied by a 15-ton track jack and transmitted from the backstop to the bearing block by two 8 x 8-inch jacking timbers 14 feet long and short lengths of railroad ties as jacking blocks.

To prevent raveling of the soil above the pipe, a metal shield was employed. Excavating ahead of the pipe was done with a



General Arrangement of Jacking Equipment in the Approach Trench



The Pressure Exerted by a 15-Ton Track Jack Was Ample to Push the Pipe into the Embankment

short handled adze and a small shovel, the excavated material being removed in a small wooden box with wooden runners. Where the material was saturated and unstable, it was excavated only at the bottom and was sheared off at the top by the head end of the shield as the pipe was pushed ahead. In this way, it was thought that a number of cave-ins were averted. The rate of progress for the first pipe was 1.1 feet an hour and for the second pipe about 2 feet.

J. T. Moye, Jr., Construction Superintendent, and Ed. Ruthven, Foreman, were in immediate charge of the two jacking jobs, which were handled under the general supervision of M. Fitzgerald, Engineer.

Quantity Surveys

THE construction industry is, to a great extent, what the builder makes it. If conditions in the industry are in a deplorable state it is within the power of the builder to bring about a more ethical, efficient and economical progress. The most irritating problems before the builder are unfair competition, inefficiency and high cost production. To solve these it is necessary to discard the old ways and means of doing business.

Unfair competition, with its many bad results, did not start with the builder and will not end with him in spite of the beliefs to the contrary. Good business, as well as bad business, starts

with the client. The builder who has the courage to demand a positive instrument of purchase will get it. A positive instrument of purchase, professional survey—will form a basis for fair competition.

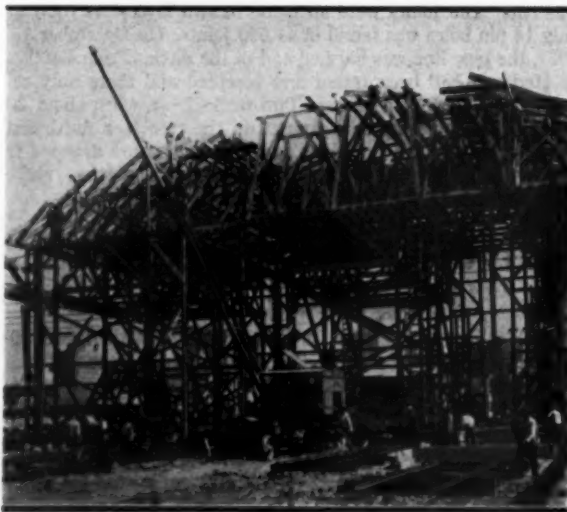
Reputable architects are in favor of furnishing a construction survey with the plans and specifications just as soon as reputable builders ask for it. Some of the benefits of surveys are included in the following: they encourage honesty by exposing the facts otherwise unknown to buyer and seller; they create fairness in competition by positively showing that quantity and quality, and not price, are the basis of fair competition; they produce confidence, good will and satisfaction by honest and fair dealing; they provide accurate preliminary records on the relative values of material and workmanship, essential for economical design; they create positive current records required for buying and selling; they produce future reference records which are valuable for arbitration, investigation and valuation purposes; they simplify by systematic classification of the actual requirements; they exclude "unforeseen contingencies" by reducing the "real items" to their actual quantity and quality value; they speed construction progress by defining where, who, and what can, shall or has been done and when.

The fact that neither the architect nor the builder is responsible for the preparation of a professional survey is the most essential thing in its favor and makes the survey valuable as a non-partial equalizing medium. The surveyor, as an indication of true competency, is ready to guarantee his survey. The cost of the survey is paid by the client in any case and the more directly he pays it, the less it costs. The surveyor's fee may be paid by the client, incorporated within the fee of the architect or specified to be included within the contract of the builder.

Construction surveys are used on lump-sum, cost plus percentage, unit price or any other form of contract, the survey in any case performing its economical function.

ACKNOWLEDGMENT: From an address delivered by G. Szamak, Chairman of the Publicity Committee of the American Institute of Quantity Surveyors, before the New York State Association of Builders.

The Skeleton of the Democrat's Convention Hall at Houston, Texas



The building is 260 feet wide and 320 feet long, consisting of two side wings 70 feet wide and 35 feet high, and a center bay 120 feet wide and 55 feet high. The timber work of the building is being erected by the Coffman-Werner Crane Service Co., of Houston, using a 6-ton Universal crane mounted on a White chassis and equipped with a 55-foot boom

Who's Who in Construction

A Series of Reports from Active Contractors Published Monthly

BUS. VOL.—ANNUAL VOLUME OF CONTRACTS

- A—Over \$5,000,000
- B—Between \$1,000,000 and \$5,000,000
- C—Between \$500,000 and \$1,000,000
- D—Between \$250,000 and \$500,000
- E—Under \$250,000

Edwards & Flood, Inc., Brooklyn, N. Y., 186 Joralemon Street. Organized 1919. Bus. vol. D. This company was organized and incorporated in 1919 under the laws of the State of New York and there has been no reorganization since incorporation, the same officers having held over since incorporation. Officers: Dean G. Edwards, President; John F. Flood, Secretary and Treasurer. Major contracts: 1926, demolition of Washington Park Ball Stands, Brooklyn, N. Y., for the Brooklyn Edison Co., \$65,000; 1927, relocating trolley line, overhead work and bonding for the New York & Queens Traction Co., \$50,000; 1926-27, lengthening Elevated Station platforms of the West End Line, Brooklyn, N. Y., for the Board of Transportation, \$100,000, and lengthening the Subway Station platforms on the Broadway Line, Brooklyn, N. Y., for the Board of Transportation, \$100,000; constructing the Sixth Avenue Highway Bridge, Brooklyn, N. Y., for the Long Island Railroad and New York Rapid Transit Corporation, \$125,000; 1928, miscellaneous construction at the Hudson Avenue Power Station, Brooklyn, N. Y., for the Brooklyn Edison Co., \$100,000, and construction of the Botanic Gardens Station, Brooklyn, N. Y., for the New York Rapid Transit Corporation, \$200,000. Member: General Contractors Association of New York, and A. G. C. of A.



Dean G. Edwards

Cedar Construction Co., Inc., Cedar City, Utah. Bus. vol. E. This company was originally the Higbie Construction Co. It was reorganized in 1926. Officers: A. L. Merrill, President; R. T. Forbes, Secretary-Manager. Major contracts: Zion Canyon, Rockville Road; 120 miles telephone line from Union Pacific to Grand Canyon; 25 miles of power line to Zion Canyon; Webster-Escalante Road; Kanarre, Washington County Road. Member: Intermountain A. G. C. of A.

Hickey & Harrington, Dallas, Texas, 623 Construction Building and 819 Petroleum Building, Houston, Texas. Organized 1925. Bus. vol. B. The firm of Hickey & Montgomery was organized in 1919. Mr. Montgomery withdrew in 1925, and the organization continued practically intact under the present name, Mr. Harrington having been Manager of the former company for several years. Officers: Louis W. Hickey and D. V. Harrington, Managing Partners; O. W. Collins, General Field Manager. Major contract: 1926, Petroleum Building, Houston, Texas, a \$1,600,000 office building. Member: Dallas Chamber of Commerce, U. S. Chamber of Commerce, and A. G. C. of A. Mr. Hickey is a member of the National Advisory Board of the A. G. C. of A., and Past President of the Texas Branch, and of the Dallas Chapter. He is a National Councillor for the Texas Branch in the U. S. Chamber of Commerce.

Shultz Construction Co., Wichita, Kans., 901 Union National Bank Building. Organized 1923. Bus. vol. C. Officers: Roy Shultz and Corbett Shultz, Partners; H. R. Hunter, General Manager. Major contracts: 500 miles of

highway construction of all types, including earth, gravel, concrete, etc. Member:

Frederick Snare Corporation, New York, 114 Liberty Street. Branch offices: Philadelphia, Pa.; Havana, Cuba; Lima, Peru. Organized 1900. Bus. vol. B. Since first organized this company has completed over 1700 contracts consisting of steamship terminals, piers, pier sheds, railroad terminals, power houses, dams and reservoirs. Officers: Frederick Snare, Chairman of the Board; Arthur W. Buttenheim, President; Edward S. Skillin, Vice-president of the Contracting Department; G. P. Seeley, Jr., Vice-president of the West Indies Department; Randall Cremer, Vice-president of Operations; F. J. Litter, Chief Engineer; Frederick Snare, Jr., Secretary and Treasurer. Major contracts: A new steamship terminal in Callao, Peru, to cost about \$7,000,000; sub- and superstructure work of the Hudson Avenue Power House of the Brooklyn Edison Co., costing about \$8,000,000; foundation work for the New York Approaches of the Port of New York Authority Bridges between Howland Hook, N. Y. and Elizabethport, N. J. and between Tottenville, N. Y. and Perth Amboy, N. J. Member: General Contractors Association, Merchants Association, National Association of Manufacturers, and A. G. C. of A.

Southeastern Construction Co., Charlotte, N. C., 210 West Second Street. Organized September, 1921. Bus. vol. C. Officers: Earle Whitton, President; H. S. Cushman, Vice-president. Major contracts: 1924, 1925, 1926 and 1927, Johnston C. Smith University, Charlotte, N. C.; 1925, St. Joseph's Sanatorium, Asheville, N. C.; 1926, Hanes Hosiery Mills, Winston-Salem, N. C.; 1927, Catholic Orphanage, Raleigh, N. C. Member: Charlotte Chamber of Commerce, A. G. C. of A.

H. G. Christman-Lansing Co., Lansing, Mich., Bus. vol. B. This company was formerly the Lansing branch of the H. G. Christman Co. of South Bend, Ind. Officers: H. G. Christman, President; Harry L. Conrad, Vice-president and Chief Engineer. Major contracts: 1926, Hayes Hotel, Jackson, Mich.; 1926-1927, Jackson, Mich., High School; Lansing, Mich., Y. W. C. A.; 1927, Chevrolet Motor Co. office building and factory additions, Flint, Mich., and 1928, Chevrolet new plant at Bay City, Grape Nuts factory for Postum, Inc., Battle Creek, Mich., Durant Motor Co. new plant at Lansing. Member: Associated Building Employers, and A. G. C. of A.

Kuckenberg Wittman Co., Inc., Portland, Ore., 226 Board of Trade Building. Organized November 1, 1927. Bus. vol. D. This was originally a partnership of Andrew Wittman and H. A. Kuckenberg, formed in 1922. Officers: H. A. Kuckenberg, President and Manager; A. Wittman, Vice-president. Major contracts: 1926, Crooked River Bridge, Jefferson County, Ore.; 1927, Vantage Ferry Bridge, across the Columbia River, near Ellensburg, Wash., and DePoe Bay Bridge, Lincoln County, Ore. Member: A. G. C. of A.

Fruin-Colnon Contracting Co., St. Louis, Mo., 502 Merchants-Laclede Building. Organized June 4, 1908. Bus. vol. B. Officers: A. P. Greensfelder, President; J. E. Vollmar, 1st Vice-president; S. W. Bowen, 2nd Vice-president; E. C. Dieke, Secretary; A. H. Randall, Treasurer. Major contracts: St. Louis Union Market; 18th Street Garage; Woodward-Tiernan Printing Plant; McKinley Bridge Approach; Civil Court House sub-structure work; More-Jones Factory Bldg.; Mo.-Ill. Stores Co. office and warehouse; Northamp-

ton Subdivision. Member: The Master Builders Assn. of St. Louis, and A. G. C. of A.

Bryant Paving Co., Waterloo, Iowa, 807 Blackhawk Building. Organized 1908. Bus. vol. B. Officers: P. L. Bryant, President; L. W. Bryant, Secretary. Major contracts: 1927, 65 miles of concrete highway paving in Benton, Tama, and Bremer Counties, Iowa. Member: Central Branch, A. G. C. of A.



P. L. Bryant

Mason & Hanger Co., Inc., New York, 4975 Broadway. Branch offices: Richmond and Lexington, Ky. Organized 1907. Bus. vol. B. This contracting business was originally established by Capt. Clayborn Rice Mason in Virginia sometime during 1827. The Mason Co. engaged in railroad construction on the first rail line built in this country, and the organization has had continuous contracts on the Chesapeake & Ohio Railroad construction from 1836 to 1861. After the Civil War operations were extended into Pennsylvania and Kentucky. One of the most conspicuous jobs was the construction of a considerable part of the Chicago Drainage Canal. For the past 40 odd years, the various Mason companies have been doing general heavy construction work, specializing in tunnel, subway and bridge foundation. Officers: Silas B. Mason, President; John J. Watts, Secretary; W. Arnold Hanger, Treasurer; Arthur J. Sackett, Chief Engineer. Major contracts: 1925, subsurface Rapid Transit Railway contract with Board of Transportation, New York, for Route 105, Section 2; 1926, subsurface Rapid Transit Railway contract with Board of Transportation, New York, tunnel section under Washington Heights; 1927, Upper Delaware Collecting Sewer, Section 1, bridge foundations and tower bases for the New Jersey tower of the Hudson River Bridge at Fort Lee, and subsurface railway contract with Board of Transportation, New York, Route 101, Section 1, including two tubes under the Hudson River from Manhattan to Brooklyn. Member: General Contractors Association and A. G. C. of A.

Whitney Brothers Co., Duluth, Minn., 909 Alworth Building. Branch office: Book Building, Detroit, Mich. Organized 1904. Bus. vol. B. This company was founded in 1889 by William A. Whitney. It was changed to a partnership in 1893 and to a corporation in 1904. Officers: Gwin A. Whitney, President and General Manager; E. H. Whitney, Vice-president; J. R. Stack, General Superintendent; E. A. Banister, Secretary and Treasurer; L. M. Mitchell, Chief Engineer. Major contracts: 20,000,000-gallon reservoir for the city of Detroit, Mich.; terminal warehouse, docks and dredging for the Terminal & Transportation Corporation, in Chicago and Buffalo; Detroit Rail & Harbor Terminal, docks, foundations, etc.; ore dock substructure for the M. S. P. & S. S. M. Ry. at Ashland, Wis.; coal dock for the Ford Motor Co., Duluth; breakwater for the U. S. Engineers, Marquette, Mich.; ore docks for the Duluth, Missabe & Nor. Ry., and the Duluth & Iron Range R. R., warehouses, foundations, etc., for the Boston & Maine Terminal at Boston, Mass.; and Townsite, Canals, etc., for the Amer. British Improvement Corp., at Fort Lauderdale, Fla. Member: Duluth Builders Exchange, U. S. Chamber of Commerce, A. G. C. of A., Duluth Chamber of Commerce.

Robert E. McKee, El Paso, Texas, 1900-32 Texas Street, and 1128 Central Building, Los Angeles, Calif. Branch offices: In various parts of Calif., N. M., Ariz. and Western Texas. Organized 1912. Bus. vol. B. Officers: E. D. Piatt, Manager of the El Paso office, and M. C. Shedd, Manager of the Los Angeles office. Major contracts: 1924, County Court House at Albuquerque; 1925, A. T. & S. F. shops at San Bernardino, Calif.; 1926, section houses of Southern

Pacific Railway in Arizona, and Hilton Hotel at Abilene, Tex.; 1927, Mimms Building, Abilene, Tex., and Seharbauer Hotel, Midland, Tex. Member: A. G. C. of A.

Froemming Bros., Inc., Milwaukee, Wis., 1326 Humboldt Avenue. Organized March, 1922. Bus. vol. D. This business was incorporated in 1902 under the name of Froemming Bros. Quarry Co. Officers: Walter A. Froemming, President; Jos. D. Bonness, Vice-president; Ben Froemming, Secretary and Treasurer. Major contracts: 1924-1925, contracts for the Pennsylvania State Highway Department; 1924 to 1927, contracts in Milwaukee; 1927, road work for the Wisconsin State Highway Commission in Marathon County. Member: Wisconsin Municipal & Highway Contractors Association, and A. G. C. of A.

Edgar V. Anderson, Poughkeepsie, N. Y., 25 Market Street. Organized 1914. Bus. vol. C. Major contracts: 1924, Public School No. 8, Poughkeepsie, and Laboratory of Physics, Vassar College; 1926-1927, Residence Hall and Nursery School, Vassar College; 1927, Llyall Memorial Church, Millbrook. Member: New York State Association of Builders, Poughkeepsie Builders Exchange, A. G. C. of A.

Smiser Construction Co., Oklahoma City, Okla., 2300 N. Broadway. Organized 1925. Bus. vol. D. This company was originally organized as H. P. Smiser, Contractor, Shawnee, Okla. It was moved to Oklahoma City in 1909, and was organized into a partnership in 1919. Officers: H. P. Smiser, President; R. H. Smiser, Secretary and Treasurer. Major contracts: 1924, Alexander Drug Addition; 1925, Noble Building; 1926, Telephone Building at Norman, Okla.; 1927, Miller-Jackson Warehouse, and Physical Education Building for the Central State Teachers College at Edmond, Okla.; 1925 to 1927, many private residences; 1927, Chevrolet Motor Co. warehouse. Member: Oklahoma City Chamber of Commerce, local and national chapters, A. G. C. of A.

Wm. Miller & Son, Cincinnati, Ohio, 2017 Elm St., (1942-58 Central Parkway after July 1). Organized 1897. Bus. vol. C. Organized originally in 1868 and remained under the partnership of Dittman & Miller until 1875. From 1875 to 1897 it was operated by Wm. Miller, Sr. At the death of Mr. Miller, Sr., Wm. H. Miller, Jr., became sole owner. Major contracts: Harrison and Norwood Exchanges of The Cincinnati & Suburban Bell Telephone Co., Cincinnati, Ohio; Schott Auto Co. Building; Groton Building; Boulevard Garage and Service Co.; Plasterers' Hall; University of Cincinnati Law School, and Electrical College. Member: Associated Building Industries of Cincinnati and Vicinity, National Safety Council, Cincinnati Chamber of Commerce, Cincinnati Businessmen's Club, and A. G. C. of A.



Wm. H. Miller

Pennell & Horley, Inc., Spartanburg, S. C., Montgomery Building. Organized September, 1925. Bus. vol. B. This business was conducted as a partnership under the name of J. M. Gregory & Co., from 1920 to 1922. Officers: J. Ray Pennell, President and Treasurer; J. B. Horley, Vice-president; W. C. Smith, Secretary. Major contracts: various paving and bridge highway projects in North and South Carolina, ranging from \$200,000 to \$400,000. Member: A. G. C. of A.

J. M. Dunn & Son, Knoxville, Tenn., Depot Street and Broadway. Organized 1900. Bus. vol. B. Officers: James M. Dunn and Oscar M. Dunn. Major contracts: Addition to Southern Railway Shops, addition to the Fulton Co., East Tenn. National Bank, Catholic Church, Central Methodist Episcopal Church, City Water-Works, and addition to the Holston Manufacturing Co., all of Knoxville. Member: Knoxville Chapter of A. G. C. of A.



Conowingo Hydro-Electric Development

Comparison	
Development	horsepower
Niagara Falls	490,000
Conowingo	375,000 (Eventually 594,000)
Muskegon	250,000
Holbrook	155,000
Keweenaw	154,000

14 PLYMOUTH

THE ARUNDEL CORPORATION
 Main Office: PIER 2 PRATT ST.
 BALTIMORE, MD.
 October 25, 1927.

Plymouth Locomotive Works,
 Plymouth, Ohio.

Gentlemen:

The work on relocation of Columbia & Port Deposit Branch of the Pennsylvania Railroad made necessary by Conowingo Hydro-electric Development covered about 16 miles of double track construction, and involved the handling of, roughly, 800,000 cu. yds. of rock and 500,000 cu. yds. of earth.

This work was performed over a period of 14 months, using 9 steam shovels. Except for the casting of possibly 100,000 cu. yds. all of the excavated material was moved into fills by 5 yard dump cars on 36 in. gauge track, the use of this small equipment being necessary on account of proximity of the old line of C. & P. D. Branch which had to be kept in operation at all times.

For the hauling of this material our motive power consisted of ten 8-ton and four 14-ton Plymouth locomotives, and two 18-ton steam locomotives. The performance of the Plymouth locomotives was satisfactory in every way.

Yours very truly,
 THE ARUNDEL CORPORATION
J. Morgan
 Chief Engineer

HELP MAKE ENGINEERING HISTORY AT CONOWINGO

To take an important part in the building of such a monument of modern engineering is in itself a satisfying thought.

To have it said that fourteen of our locomotives served satisfactorily in every way is a gratifying reward for our constant slogan—to build the best gasoline and Diesel powered locomotives in the world.

PLYMOUTH LOCOMOTIVE WORKS
 The Fate-Root-Heath Company
 263 Riggs Avenue
 PLYMOUTH, OHIO

PLYMOUTH

GASOLINE Locomotives DIESEL

ONE PURPOSE TO BUILD THE BEST GASOLINE AND DIESEL LOCOMOTIVES IN THE WORLD

Legal Points for Contractors

These brief abstracts of court decisions in the contracting field may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt consult your own attorney

Edited by A. L. H. Street, Attorney-at-Law

Owner's Liability for Delaying Contractor

THERE are numerous court decisions to the effect that an owner, whether public or private, owes a legal duty to the contractor to furnish the site in such time as will enable the contractor to proceed with the contract work without delay; that a similar obligation rests upon the owner as to other things that must be done by him or by his agents before the contractor can proceed; and that failure to observe these obligations will give the contractor a good claim for damages covering all losses that ensue as a direct and natural result of the owner's default.

One of the leading cases on this subject is *Owen vs. United States*, 44 Ct. Cl. 440, in which it was decided by the United States Court of Claims that, where the United States notified contractors who were to erect a building for the Government that bricks were on the ground, and, on the faith of such notice, the contractors sent workmen there—a place remote from a labor market—the Government became liable for loss sustained by the contractors in consequence of the men remaining idle on arriving at the site and finding that the bricks were not there as had been represented.

Said the California Supreme Court in the case of *Gray vs. Bekins*, 199 Pac. 767:

"In every building contract which contains no express covenants on the subjects there are implied covenants to the effect that the contractor shall be permitted to proceed with the construction of the building in accordance with the other terms of the contract without interference by the owner, and that he shall be given such possession of the premises as will enable him to adequately carry on the construction and complete the work agreed upon. Such terms are necessarily implied from the very nature of the contract, and a failure to observe them, not consented to by the contractor, constitutes a breach of the contract on the part of the owner entitling the contractor to rescind, although it may not amount to a technical prevention of performance."

In the case of *J. W. Brennan Construction Co. vs. State*, 191 N. Y. Supp. 253, the New York Court of Claims held that the State of New York violated a highway construction

contract, requiring the contractor to make a fill over a concrete culvert, where there was a delay in completing the culvert, although that delay was directly the fault of a town. The court said:

"The general obligation of a party to provide his construction contractor with the site for the work and to refrain from impeding its performance is not, and cannot be denied. *Cross vs. Beard*, 26 N. Y. 85, *Mansfield vs. N. Y. C. & H. R. R. Co.*, 102 N. Y. 206, 6 N. E. 386. Quoting the latter opinion:

"It is a well-settled principal of law in the construction of contracts that when the obligation of performance by one party presupposes the doing of some act on the part of the other, prior thereto, the neglect or refusal to perform such act not only dispenses with the obligation of performance by the other, but also entitles him to rescind, or when rescission will not afford him an adequate remedy, to continue the work and recover such damages as the delinquency has occasioned, against the defaulting party."

In the case of *Blanchard vs. Blackstone*, 102 Mass. 343, the Massachusetts Supreme Judicial Court decided that where a town unreasonably delayed designation of the site for a public building the builder who had contracted to erect it was entitled to damages ensuing in consequence.

Where a contractor undertook to make special installation for an owner of a building in course of construction by independent general contractors, the owner was bound to keep the building in such state of forwardness as to enable the special contractor to complete his work within the time limited, according to the decision of the Connecticut Supreme Court of *Errors* in the case of *Stehlin-Miller-Henes Co. vs. City of Bridgeport*, 117 Atl. 811. "The Court remarked:

"The rule is undoubted in circumstances such as were present in this case that an implied contract rose on the part of the defendant [Owner] to keep the work on the building, whether done by itself or by other contractors, in such a state of forwardness as would enable the plaintiff to complete its contracts within the time limited."

Fortunately for the contractor, the court did not help the witness get even with him.

"Getting Even" with the Mason

A "concrete" example of the truism that the law and lawyers are not responsible for all miscarriages of justice, or attempted miscarriages of right—that conscienceless witnesses have their share in these untoward results—is afforded by the recent decision of the Maine Supreme Judicial Court in the case of *Burke vs. Langlois*, 139 Atl. 675, decided January 5, 1928.

A question before the trial court was whether a concrete wall constructed by a contractor was worthless or whether its defects could be remedied by resurfacing. The Supreme Judicial Court said:

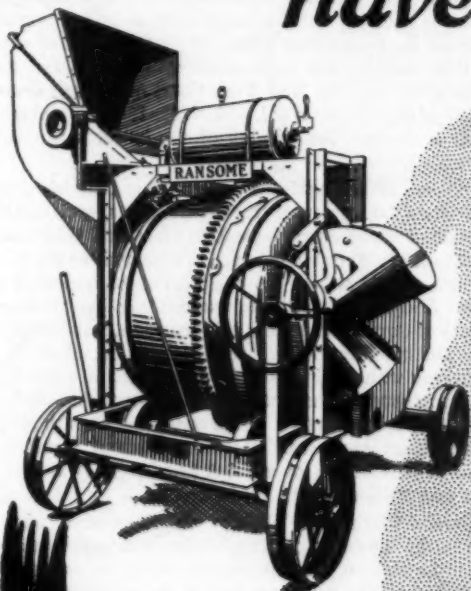
"Langlois [the owner] claimed that the wall was wholly worthless and would have to be replaced; but his only witness to that effect was one who admitted that he had stated during the course of the trial that he proposed to get even in this case with the mason who built the wall!"

Contractor's Responsibility Concerning Defective Wall

An owner came out second best in cross-lawsuits with a contractor over the latter's responsibility concerning defects in a foundation wall. This was in the case of *Burke vs. Langlois*, 139 Atl. 675, decided by the Maine Supreme Judicial Court January 5, 1928.

Faults for peeling and cracking of the concrete in the wall lay between surface and subsurface drainage conditions, running the concrete on a cold day on the owner's insistence, and failure of the contractor to use steam or hot water in preparing the concrete. As to the first of these causes, the court said:

7-S & 10-S Standard *Ransome* Building MIXERS have the **PUNCH!**



FRONT AXLE—built of two 4" Channels, width 1½" cold rolled stubs.

MAIN FRAMES—made of two 6" Channels.

MAIN ROLLERS—12" in diameter.

In This Corner We Have The Ransome 10-S

DRUM—51" in diameter by 39" wide.

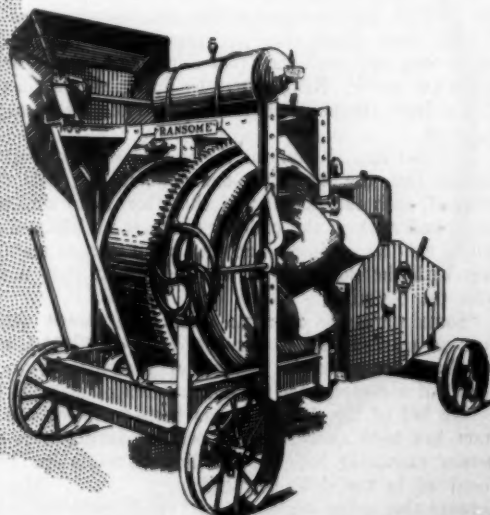
DRUM ROLLERS—12" x 2½"—car wheel iron, Timken Roller Bearings on Drum Rollers.

CONTROL—One set of levers located at drum end of mixer.

GASOLINE ENGINE—LeRoi or Novo—4 cylinder.

WATER MEASURING TANK—16" x 40"—capacity, 37 gallons.

*Ransome—the first mixer in the ring
—the last to enter the repair shop.*



Fast, rugged mixers that knock out the work in record time—that is the general reputation of Ransome 7-S and 10-S among mixer "fans".

Look over the measurements of the 7-S—then you'll see why it has the "guts" to stand up and "take" it.

DRUM—45" in diameter by 35½" wide.

DRUM ROLLER TRACKS—2" wide—1½" thick, forged rolled and turned from solid billets of locomotive tire steel.

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Ransome Concrete Machinery Company

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1890—Service for 70 Years—1920

New Jersey

Get ALL of the facts about these fast, husky Ransome Mixers. Learn how they've performed—what they're made of!

RANSOME CONCRETE MACHINERY COMPANY
Dept. C Dunellen, N. J.

Without obligation, send me full information about the ☐ 7-S Tiller; ☐ 5-S Builder;
☐ 7-S Builder; ☐ 10-S Builder.

Name _____

Address _____ City _____ State _____

"It is quite evident that a system of drainage was necessary to carry off the water in the soil about the building and the surface water that naturally flowed down against the wall, and for this Burke [the contractor] was not responsible, and was under no obligation to provide against."

The evidence being conflicting as to the defects being to any extent due to running the concrete on a cold day, against the contractor's advice, and to his failure to use steam or hot water, it was decided that the jury's finding on those points was conclusive.

But since the contractor seems to have conceded responsibility to the extent of the cost of resurfacing the wall the court approved the jury's action in allowing the owner credit for that item.

Right to Enjoin Competing Contractor from Using Similar Name

"Please do not adopt the name 'Eastern Engineering Corporation,' for it will create confusion to our prejudice," said the officers of the Eastern Construction Co. to a competing organization.

"We are sorry we cannot comply," replied the Engineering Corporation. "There is but one word out of three that is common to your name and ours, and we have as much right as you have to indicate that you are doing business in the East."

A lawsuit followed, the Construction Co. seeking to enjoin the Engineering Corporation from continuing to use its name. Two courts upheld the right to injunction, but when the case was carried on further appeal to the New York Court of Appeals, the highest court of the state, that tribunal decided, one of the seven justices dissenting, that there was no infringement of the rights of the plaintiff, the Construction Co. (159 N. E. 397.) The salient parts of the opinion of the Court of Appeals handed down November 22, 1927, read:

"The plaintiff and the defendant are both engaged in the business of building construction. In the course of business both submit bids for the erection of public buildings and seek contracts for public work. Not always do they submit bids for the same work, or seek the same contract. Part of the business done by the plaintiff may lie somewhat outside the limits of the field of activities into which the defendant has entered. Within those limits they are competitors, and a court of equity may restrain them from using methods of competition which are unfair. Neither may by misrepresentation or deceit obtain from the public business which the other might have received."

"Justification, if any, for the injunction must rest upon a finding that the corporate name which the defendant has adopted, with the sanction of the state, is so similar to the name under which the plaintiff conducts its business that the public may be confused, and that some persons may do business with the defendant in the belief that they are dealing with the plaintiff."

"Some similarity of name exists, but joined with difference so marked that it can hardly be overlooked, especially by those concerned in matters of such importance as the award of a contract for the construction of a public building."

"No bid of the defendant has been accepted, and no contract has been awarded to it because an architect or other person examining bids or awarding contracts has been confused as to the defendant's identity. . . . Moreover, it appears that other building and contracting companies using the word 'Eastern' as part of their names are listed in the telephone directory."

Victim of Material Monopoly Gets Asphalt at Bottom Price

In the case of Uvalde Rock Asphalt Co. vs. Chapin-Glazier Construction Co., 299 S. W. 710, the Texas Court of Civil Appeals ruled in an opinion handed down October 19, 1927, that plaintiff was not entitled to collect a balance called for by a contract for rock asphalt. Defendant buyer success-

fully interposed the defense that plaintiff held a monopoly in the production and sale of that material in the local territory, and that, to continue the monopoly, the territory was divided into districts and favored contractors were given a price of \$3 per ton while outsiders were charged \$4 and the extra dollar was paid to the favorites.

Defendant's contract called for \$4 per ton and defendant pleaded that it had paid \$3 or more for what it got, and that therefore plaintiff was paid all it was entitled to. Speaking of the plaintiff's marketing policy, the court said:

"The result of the combination did undoubtedly increase the price of a favorite paving material, and did tend to prevent or lessen competition in the paving business, and was a handicap to most paving contractors and a burden on the state, cities, or individuals using the material controlled by appellant."

County Bridge Contract Invalid

Under the New York statutes it was necessary that plans and estimates covering the particular type of bridge proposed to be erected by a county be approved by the board of supervisors. Because there was no requirement with this and other provisions of the law, the New York Court of Appeals decided in the case of Brown vs. Ward, 159 N. E. 184, November 22, 1927, that a contract for erection of the bridge was invalid. The court said:

"The uncontradicted evidence proves . . . that for a reinforced concrete bridge across the Otselec, plans, specifications, and estimate of expense were submitted for a steel truss bridge, that the board attempted to delegate to a committee the power to enter into a contract for the construction of undefined and unspecified bridge work, that the committee in the absence of an estimate of expense advertised for bids for a concrete bridge, the plans and specifications of which were to be submitted by the contractor without approval by the board of supervisors, but to be approved by the state highway commission, and that the committee entered into a contract for the construction of a concrete bridge and a smaller culvert without approval by the board of supervisors, or without providing any reasonable basis for competition among bidders."

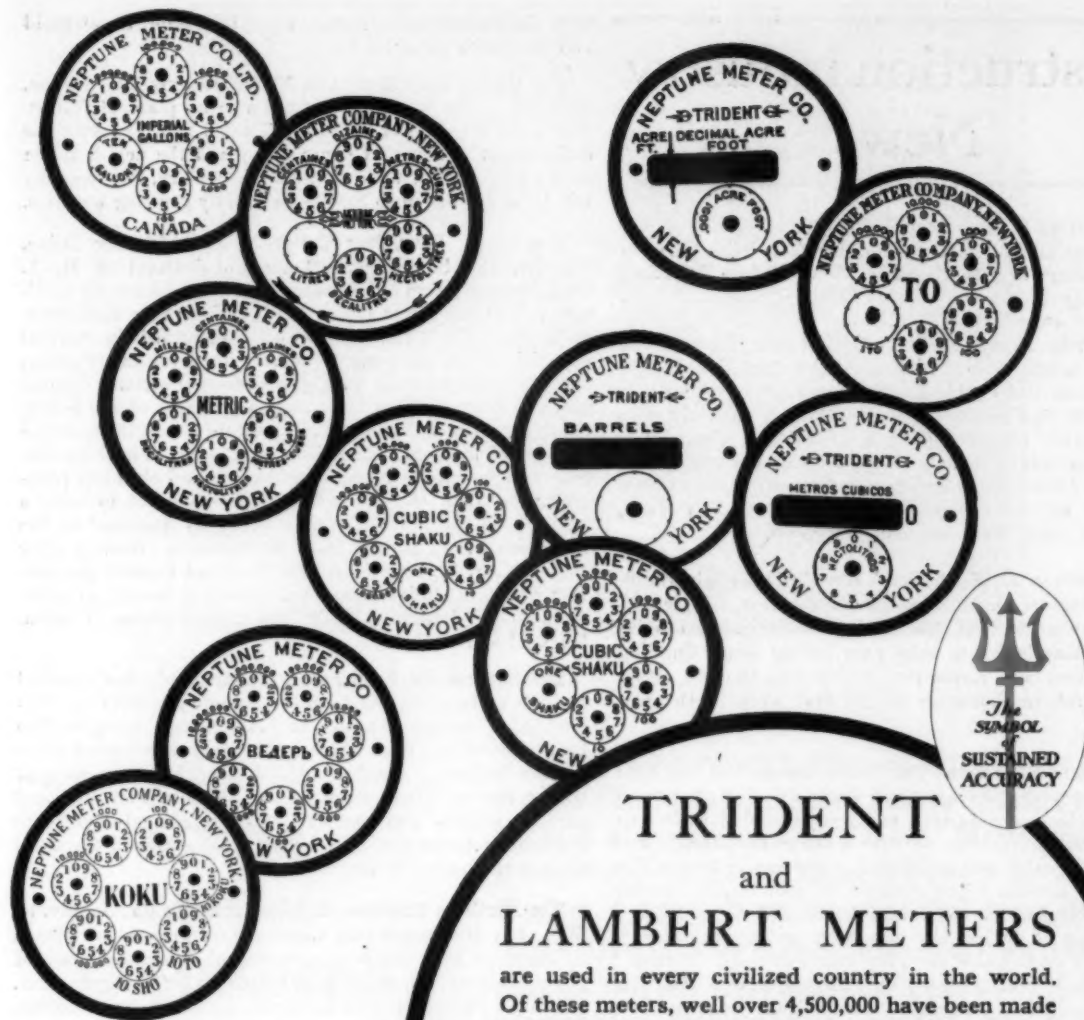
"Subdivision 3 of section 130 says that the contract shall be awarded to the lowest responsible bidder, and that he shall be deemed to be the one who specifically states the lowest gross sum, including all the items specified in the estimate. No bidder could comply with this requirement because the board had never taken any action respecting a concrete bridge. The lowest bidder is intended to be selected on the basis of definite plans and specifications."

"The courts below have found as a fact that all parties acted in good faith. This is not enough. Public officers have no power to contract except in the manner which the statute directs. Courts ought not to insist in every instance upon literal obedience to the law. Substantial compliance will be sufficient. Here we cannot avoid perceiving the most patent disregard of simple and necessary statutory requirements."

Crushed Rock Sales Contract Interpreted

An Arkansas contract for sale of crushed rock to a contracting company required it to remove the rock from the quarry "and to dispose of all spawls, dirt and refuse from said ledge, so as not to hinder further quarrying operations of the" sellers. Holding the contractor's surety liable for the cost of removing the spawls, etc., on the contractor having failed to do so, as well as for the price of the stone, the Arkansas Supreme Court said in an opinion handed down December 5, 1927 (Southern Surety Co. vs. Pfeiffer, 1 S. W. [2nd series], 43):

"The cost of removing the dirt and spawls in procuring the stone agreed to be done by the contractors, was necessarily a part of the purchase price of the stone actually furnished and used in the improvement for the balance due, upon which appellant, as surety on the bond, was liable to the payment."



**in
every
civilized
language**

TRIDENT

and

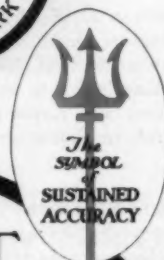
LAMBERT METERS

are used in every civilized country in the world. Of these meters, well over 4,500,000 have been made and sold. It is their accuracy in manufacture, and sustained accuracy in registration, that accounts for this world-dominance. Forthcoming pages in this journal will illustrate by text and photograph the reasons behind the accuracy of Neptune-built Meters. Watch for them.

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Yesterday—TODAY—Tomorrow*

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50 East 42nd Street
NEW YORK CITY



The Cash Registers of the Water Works Field.

Construction Industry News

The American Hoist & Derrick Co. announces the removal of the offices of its Pittsburgh branch from 1423 Farmers Bank Building to 604 Chamber of Commerce Building, effective May 1.

The Oxweld Acetylene Co., 30 East 42d Street, New York, has taken over the sales of the Carbie acetylene floodlight and the Carbie acetylene generator as well as other Carbie equipment utilizing acetylene, formerly sold by the Carbie Manufacturing Co., Duluth, Minn. The processed carbide in cake form, sold under the trade-mark Carbie, for Carbie lights and generators, will be distributed exclusively by the Union Carbide Sales Co., New York, through its nationwide chain of warehouses.

The American Road Builders' Association, Earle Building, Washington, D. C., through its Director, Charles M. Upham, announces that the Mexican Government has invited the Association to take part in the Road Building Demonstration and Exposition which will be held either the last week in September or the first week in October, 1928.

The Hazard Wire Rope Co., Wilkes-Barre, Pa., has been given a license by the American Cable Co., Inc., to manufacture preformed wire rope and processed fittings in this country. In this process of wire making, the strands and wires of the cable are preformed, resulting in longer life and better service. The product is now widely known under the trademark "Tru-Lay Preformed Wire Rope." A new type of fitting has also been developed which is known and advertised as "Tru-Loc Processed Fitting." Licenses have been granted by the American Cable Co., Inc., to three other companies, one in Canada, one in Scotland, and another in Germany, the latter having sub-licensed other manufacturers in European countries.

The C. H. & E. Manufacturing Co., Inc., Milwaukee, Wis., has issued a large, attractive anniversary book illustrating the C. H. & E. line of saw rigs, diaphragm pumps, lift and force pumps, centrifugal pumps, triplex pumps, hoists, mortar mixers, and material elevators, as manufactured today, after twenty years' service. It is a 37-page book, 16 by 12½ inches, bound in a Chinese red cover, and enclosed in a red folio.

The Black & Decker Manufacturing Co., Towson, Md., has announced the removal of its Detroit branch to new quarters at 11501 Woodward Avenue, Detroit. J. H. Walker is Manager of this branch, succeeding H. B. Hazenrodt. Other changes in the sales organization include: H. L. Balke, who is with the Kansas City branch, covering the territory around Omaha, formerly covered by S. D. Shawgo; G. F. Parr is with the Buffalo office, succeeding J. H. Hutton; G. N. McCarthy has filled the vacancy at the Buffalo office, made by H. B. Austin's transfer to Chicago; and J. A. Murray is in the Baltimore branch, formerly covered by Curtiss Watts.

The T. L. Smith Co., 1030 32d Street, Milwaukee, Wis., manufacturers of Smith mixers and pavers, has announced the appointment of the R. P. Sweeny Co., of Greenville, S. C., as its representative for the State of South Carolina,

with the exception of Chester, York, Lancaster, Chesterfield and Marlboro Counties.

The Galion Iron Works & Manufacturing Co., Galion, Ohio, has recently built an addition to its plant at Galion. It is a brick and steel building, 90 x 340 feet, and with the entire plant working 24 hours a day and the new building modernly equipped with the latest machinery, the company will be in a position to handle its rapidly growing business.

The Bates Valve Bag Corp., 35 East Wacker Drive, Chicago, Ill., has announced the appointment of H. A. Schaffer as Eastern Sales Manager, who will have his headquarters at the Bates offices in New York City and Nazareth, Pa. Mr. Schaffer has been identified in various capacities with the cement industry for over thirty years, first as Chief Chemist of the Vulcanite Portland Cement Co., and later as Chief Chemist and Manager of the Northampton Portland Cement Co. From 1914 to 1918, he was a member of the firm of Harrison & Schaffer, Consulting Engineers, specializing in mill engineering and chemical problems. In 1918 he was called to Washington to take a position on the War Industries Board as Assistant to the Director of the Building Materials Division. Shortly after the war, Mr. Schaffer joined the Portland Cement Association as Conservation Engineer, making a survey of processes in the leading mills of the United States, Canada, England and Europe.

The Chausse Oil Burner Co., Elkhart, Ind., has reported the sale of two Chausse portable asphalt plants to the District of Columbia for use in maintenance work on the Capital streets. With these machines were shipped three surface heaters. Another asphalt plant has been shipped to the city of Little Rock, Ark. Shipments of tool and surface heaters and tar kettles to municipal and state highway departments this spring have exceeded the total annual shipments of previous years.

The Northern Conveyor & Manufacturing Co., Janesville, Wis., has announced that patents were granted on March 8, 1928, to that company covering the combined use of shaker screens and portable conveyors. According to G. R. Whitnall, Secretary, this company pioneered the combination of portable belt conveyor with a shaker screen directly mounted on the conveyor, furnishing a complete portable loading and screening plant for the use of contractors and small gravel pit operators.

The T. L. Smith Co., Milwaukee, Wis., manufacturer of concrete mixers and pavers, has announced the appointment of the Service Supply Corp., 20th and Venango Streets, Philadelphia, Pa., as distributor for Smith mixers and pavers in eastern Pennsylvania, southern New Jersey and northern Delaware.

The Pennsylvania-Dixie Cement Corp., 131 East 46th Street, New York, has purchased the Pyramid Portland Cement Co., Des Moines, Iowa, which has an annual production of 1,250,000 barrels of cement. The combined production of the Pennsylvania-Dixie Cement Corp. and the North American Cement Corp. has been submitted to the stockholders of the two corporations for approval. If favorably acted upon, this corporation at its various plants will produce 16,750,000 barrels per year.

The Manitowoc Engineering Works, a division of the Manitowoc Shipbuilding Corp., Manitowoc, Wis., has announced that the Moore speed crane will now be built and sold by the Manitowoc Engineering Works, by a recent arrangement with the Moore Speed Crane Co., Chicago, Ill., which continues as sales representatives in Chicago for Manitowoc, and an extensive manufacturing program is planned.



n-810-L

Waukesha-Equipped P & H Shovel on Cuban Central Highway

Libre Cuba con el Waukesha

Thirty years ago the Maine was blown up at Havana. American intervention lifted the Spanish Yoke. Now modern gasoline-driven machinery is freeing Cuba from her medieval roads that only the high-wheeled, slow-going ox-carts could navigate. Today 14 P & H shovels powered with Waukesha Ricardo Head engines are busy at work on the great 700 mile Cuban Central Highway, that will cost over \$75,000,000 in the next 10 years.

Tropical work is a great test of engine cooling. One of the important characteristics of the "Ricardo Head" is that it makes an engine run cooler when under heavy load. In this service reliability is another essential requirement, for repair parts may be weeks away. Simplicity of design is also important, permitting field service to be quickly given when required. Power, simplicity and reliability are outstanding features of all Waukesha engines. That is why more power shovels are equipped with Waukesha engines than any other make.

N-827-L

INDUSTRIAL EQUIPMENT DIVISION

WAUKESHA MOTOR COMPANY

Waukesha Wisconsin

New York
8 W. 40th St.

Tulsa
C. F. Camp Co.

Houston
Portable Rig Co.

San Francisco
C. A. Watts

Exclusive Builders of Heavy Duty Gasoline Engines for Over Twenty Years



The U. S. Steel Dirt Scraper

A New Fresno Tractor Hitch

A NEW fresno tractor hitch that is an efficient, one-man, tractor-drawn unit has been developed by the U. S. Factories Co., Sidney, Ohio. It moves earth economically and operates behind any make tractor without any mechanical changes or special attachments. It loads automatically, and is a simple, sturdy and reliable unit.

This hitch can be used with any make of horse-drawn fresno, thereby enabling the user to wear out the fresnos that he now owns. The one size hitch will fit either a 4- or 5-foot fresno.

Operation of this hitch is simple. The driver has but one operation to perform in addition to driving the tractor. To dump the load he must pull the dumping lever. One pull spreads the load, a second pull dumps the load in a pile. It loads automatically and no manual control is required in filling or getting the scraper out of the ground with its load. A simple mechanism regulates the depth of the cut and keeps the draft under the limits of the tractors drawbar pull. This automatically prevents slipping and slowing up of the normal tractor speed.

A Timber Saw With Air Motor

A NEW type of drive has been announced by the Reed-Prentice Corporation, Worcester, Mass., for the Wolf portable timber sawing machine. This new drive is an Ingersoll-Rand Type-A air motor which is a standard unit. The operation of the air-driven Wolf saw compares favorably in every way with the previously announced electrically-driven machine and, with the exception of the motor, throttle, motor housing and drive gears, is identical in design and construction.

The manufacturers claim savings as high as \$40 per day can be made with this machine by contractors, railroads, timber treating plants, lumber yards, etc., and it has already been used to a depth of 24 feet under water for cutting piling. Any operation handled with ordinary cross-cut saws can be done more rapidly with the Wolf saw, at the same time eliminating the extremely hard labor of this kind of work, so that production is at the same rate at 4 P. M. as at 9 A. M.

This machine has a capacity to cut timbers up to 24 inches in diameter and weighs only 95 pounds. A minimum of 80



The Wolf Portable Timber Saw with Ingersoll-Rand Air Motor Drive

pounds pressure and a volume of 70 cubic feet per minute is necessary to insure satisfactory operation. At 90 pounds pressure, it will cut a 12 x 12-inch fir timber in 40 seconds, according to the manufacturers' statement.

A Compact, 2-Cylinder Power Unit

ONE of the new products of interest to contractors and others in the construction field is a power unit of the Continental Motors Corporation, Industrial Equipment Division, Muskegon, Mich., the Model P-10 power unit equipped with the Model Y-2 motor. This unit is designed for all-round use where space is limited and where a power range of from 8 to 14 horsepower is required. It is compact, with smaller than usual dimensions, and at the same time permits easy access to the motor.



The New Red Seal 2-Cylinder Continental Industrial Power Unit, Model P-10

The Y-2 motor is of 2 cylinders, 3 $\frac{3}{8}$ -inch bore and 4 $\frac{1}{4}$ -inch stroke, with a displacement of 76,042 cubic inches. It provides 8 horsepower at 1000 r.p.m. and 14 horsepower at 2,200 r.p.m., with 10 horsepower at 1,250 r.p.m., recommended governed speed.

The crankshaft has two counter-balanced bearings, 2 $\frac{1}{4}$ inches in diameter. The gear-type oil pump is driven from the magneto shaft, with pressure feed to all crankshaft bearings, connecting rod bearings, camshaft bearings and timing gears. The thermo-syphon system is used for cooling. The carburetor may be located on the right or left side of the motor as desired. The gasoline tank is mounted above the cylinder head in line with the upper radiator tank.

The engine mountings are 3 $\frac{1}{2}$ x 2 $\frac{1}{2}$ -inch angles bolted to the side of the crankcase. Adapters to make the unit interchangeable with any standard mounting can be furnished on request.

Efficient cooperation in your low-cost construction program

TWENTY-THREE years now since Barrett started doing the pioneer work on low-cost construction. During all that stretch of time, this organization has been gathering information on the subject of low-cost roads—solving all sorts of construction and maintenance problems and improving old methods of procedure.

Today, most highway officials consider Barrett the logical organization to help carry out a low-cost program efficiently and promptly. In brief here's what you can depend on:

1. That a Barrett field man will place at your disposal this accumulated experience on low-cost construction.
2. That Tarvia deliveries will be made by Barrett—where, when and as wanted.
3. That Tarvia will be applied from Barrett equipment by specially trained Barrett men—the whole operation supervised by expert Barrett field men.

In short, you'll find that the "guess" element in low-cost construction is eliminated by Barrett experience, equipment and facilities.

A post card will bring the Tarvia field man.

Tarvia
*For Road Construction
Repair and Maintenance*

The *Barrett* Company

New York
St. Louis
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Cleveland
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Lebanon

Boston
Kansas City
Columbus
Rochester

In Canada:

THE BARRETT COMPANY, Limited: Montreal, Toronto, Winnipeg, Vancouver



The Osgood Heavy-Duty "Conqueror"

A New Gasoline Shovel

A NEW gasoline shovel of the full revolving type and fully convertible to dragline, back hoe, clamshell and crane service, has been produced by The Osgood Co., Marion, Ohio. It is known as the Conqueror, and is mounted on a new and improved continuous tread truck frame of the double-chain drive type. It is simple and sturdy in construction, is economical in maintenance, and all mechanical parts are readily accessible.

As a shovel, this machine carries a minimum length boom of 20 feet and a handle of 15 feet, with a back hitch type dipper. For crane service it carries a 45-foot boom of the structural latticebow type, with built-in tagline and with a fairlead for dragline service self-adjusting to any angle of the boom.

In converting the Conqueror from shovel to clamshell, back hoe or dragline service, no additions or changes are necessary in the operating machinery. The only changes required are those involved in changing the boom assemblies, this work being done in the field in a few hours time.

An 80-horsepower, 6-cylinder gasoline motor is mounted at the rear of the machine on the steel main-body frame casting. Heavy unit steel side frames securely attached to the main body casting support the drum shaft and the reversing shaft. In this way, complete alignment of parts is constantly assured, and vibration is reduced to the minimum.

A combination, cast iron gasoline tank and counterweight set into the deck at the rear of the motor is a special feature, thereby saving space and extra counter weight and at the same time reducing the fire hazard because of the thick heavy walls of the gas tank. The gas tank, being located at deck level and eliminating the necessity of gasoline pump for filling the tank, is large, having a capacity of approximately 75 gallons, enough for a 2-day supply.

The motor is equipped with a large 6-cell, 12-volt, 112-ampere-hour storage battery, electric starter, voltage regulator, gasoline filter, Pomona air cleaner, and muffler. The voltage regulator automatically prevents the over-charging of the storage battery and maintains the charge at the proper point. An air cleaner assures an ample supply of air to the carburetor free from dust and foreign particles.

The Osgood Servo mechanism for setting the clutches on the hoisting and hold back drums, and the Osgood application of the wire rope crowd are used in this new machine. The latter is self-adjusting to various boom angles, its application being simple, with high operating efficiency. The hoisting and crowding are timed and coordinated, making it easy to cut to any grade desired. The use of two drums makes it unnecessary to add to the machinery when the shovel is converted to a clamshell or dragline.

The truck upon which the machine is mounted is

heavy and rugged, simple in construction, easy to control and maintain in operation. It has a travel speed of approximately 0.7 miles per hour and will negotiate grades in excess of 30 per cent.

The continuous tread truck is of the double-chain-drive type and is built up entirely of steel castings, with axles and cross travel shaft of hammered steel. The five travel rollers are 14 inches in diameter, mounted within each side frame. The tread links are of the improved type, one piece and overlapping, of heavily-ribbed construction.

A Volumetric and Weigh Box

A COMBINATION adjustable volumetric and weigh box has been developed by the Madsen Iron Works, Los Angeles, Calif. In this unit, both sand and rock are weighed or measured in the same 2-compartment batch box. The latch control at the discharge gate and an automatic counterbalanced closing device and lock minimize labor. The controls are so arranged that gang operation is integral. A single gate provides constant center discharge into the truck.

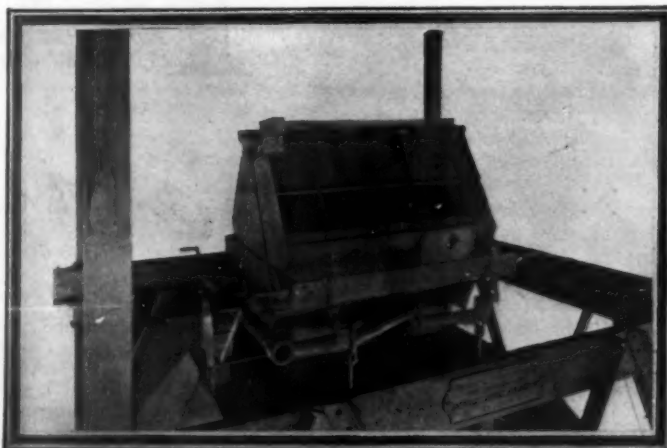
Both the sand and stone compartments are graduated in cubic feet, the collapsible hinged sides being locked at the various capacities by means of the head bolts sliding in slotted malleable iron guides. When the bolts are loosened, the sides can readily be pulled in or out to register with the capacity markings and easily tightened with an ordinary wrench.

A platform-type 5 to 1 quadruple weigh beam assembly, with dial scale, is interposed between the batch box and proportioning bin. This permits proportioning of all materials either by weight or volume without changing any equipment whatever.

A single, broad drop-gate releases both sand and stone into the mixer or truck below. The weight of the materials opens the gate when a hand latch is tripped. A toggle lock then holds the gate wide open until the hand latch is again tripped. The gate being counterweighted then snaps shut and locks automatically.

The weigh beams are equipped throughout with fully equalizing knife edges and blocks of ample dimensions to prevent undue wear. A single adjustable nose iron at the scale end of the beams makes it easy to correct any variation in scale readings with the actual weight in the box.

The batch box compartments are filled from the bin through two special pivoted and geared duplex cut-off gates which open and close quickly and always deliver centrally. These gates act as automatic strike-off devices when proportioning by volume. The gate openings are large and prevent bridging of the material flow.



The Madsen Volumetric and Weigh Box



You can save two weeks with 3-C CALCIUM

In concrete road construction, saving time means saving money.

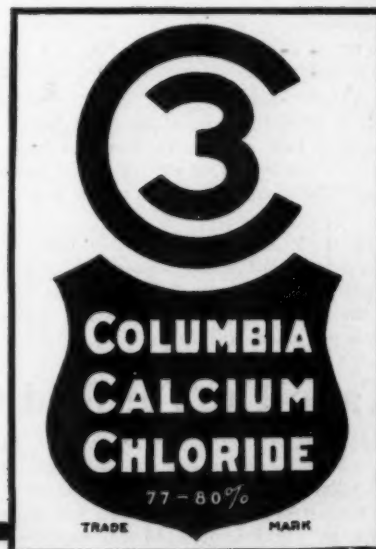
Columbia "3-C" Brand Calcium Chloride cuts two weeks from the usual curing time. Tests have proved that concrete cured by this method shows greater strength and density at the end of seven days than is obtained in 21 days by ordinary methods—and at a cost of less than 5 cents to each 100 pounds of cement.

Think of the multiple advantages of opening a new road 14 days sooner—the saving in time, labor, detour maintenance, etc.

Write to us for complete facts.

"3-C" Calcium Chloride is now sold direct from our factory and through 40 distributors.

COLUMBIA CHEMICAL DIVISION
The Pittsburgh Plate Glass Co.
BARBERTON, OHIO



A New Heavy-Duty Crawler Tractor

A NEW heavy-duty crawler tractor with a wide margin of reserve power beyond its standard rating has been developed by The Cleveland Tractor Co., Cleveland, Ohio, and is known as the Cletrac "40." Its speed, ease of control and short turning that permit operating in close quarters are features that make this unit especially suited for road building, road maintenance, earth moving and other jobs. The instant "one-shot" lubrication that saves time out for oiling is used. The tractor is rated at 40 horsepower at the drawbar and 55 horsepower at the power pulley.

The power is furnished by a 6-cylinder, 4-cycle, water-cooled, valve-in-head engine, with cylinders cast en bloc, and 4½-inch bore by 5-inch stroke. The force feed lubrication system for the crank shaft, connecting rods, cam shaft and valve rocker shaft is used, and splash lubrication to the cylinder walls, pis-



The New Cletrac Model-40 Heavy-Duty Unit

tons, rings and wrist pins. Delco Remy 12-volt starting, lighting and ignition units are furnished as standard equipment, with a Willard 12-volt, 120-ampere hour battery.

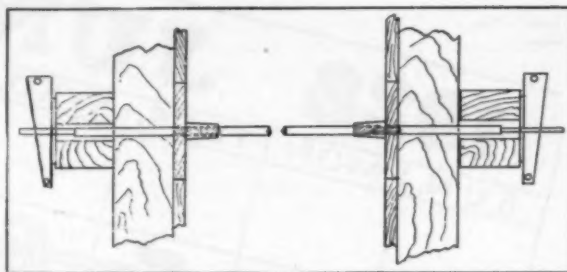
The Taco fly ball type governor is used in conjunction with hand control, for increasing motor speed. A 1¾-inch Kingston carburetor is used. The intake manifold is hot spotted above the carburetor to insure perfect vaporization of gases. All fuel lines are of copper tubing. The fuel tank capacity is 40 gallons and is mounted on the right hand fender. The transmission is the selective type, with three speeds forward and one reverse.

The 8 lower track wheel assemblies, of the plain bearing design, have cast iron bearing boxes and hardened steel shafts. Lubrication is by use of the "one-shot" force-feed system—one press of the plunger lubricates all the lower track wheel assemblies.

The track shoes are 14 inches wide, with 10-inch pitch. There are 24 carbon steel shoes in each track. The length on the ground for each track is 80 inches, and the total tractive surface is 2,240 square inches. The ground pressure is 4.5 pounds per square inch.

Take-Up Tie Rod Clamps

SIMPLICITY in design and service, ease in installation, and economy in cost are the main features of Bulldog take-up tie rod clamps, manufactured by the J. M. Willard Co., 1083 West 30th Street, Los Angeles, Calif. These clamps are easily understood and used by the most inexperienced men on the job. They afford safe and sure construction,



The New Willard Bulldog Tie Rod Clamp

are made of steel throughout, and there is nothing to get broken or get out of order.

A carpenter's hammer and wrench are all that is necessary to install and remove the clamps. They can be used on either a straight or a battered wall without extra parts or wedges. They can be inspected to determine if the bolt is properly home in the sleeve nut and corrections can be made after the forms are complete.

There is no insertion and removal of spacers with these clamps. It is not necessary to pull rods and there are no surface patches required. The sleeve nut is backed out with a wrench and leaves only a small clean hole. The sleeve nut is finished all over and galvanized so that it will not rust nor bind.

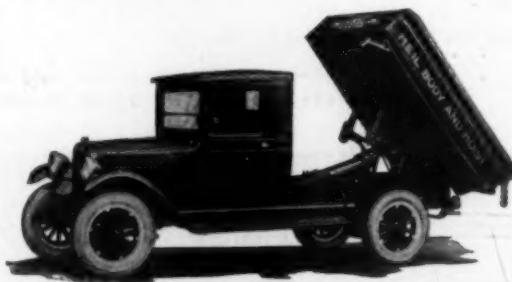
A New Hoist for Light Trucks

OPERATORS of light-duty trucks need no longer depend on hand hoists and gravity dumps. The Heil Co., 1242-60 26th Avenue, Milwaukee, Wis., is now manufacturing a new H-2 Hydro hoist which affords light-duty power for operating dump equipment and that has the same advantages as the heavy-duty dumpers. A dumping angle of 56 degrees is possible and the hoist will dump a full load in 5 to 9 seconds, depending on the speed of the motor. The racking of the truck body and frame is eliminated and the hoist is speedier than the hand hoist and eliminates the necessity of hand power to dump the load.

The hoist comes assembled as a unit on a special subframe ready to mount on the truck chassis. Only four U-bolts are needed to fasten the hoist to the chassis.

With an H-2 Hydro hoist installation it is also possible to use the truck for other purposes, as the four U-bolts can be taken off in a few moments and the body and hoist removed. It can be disconnected from the lifting arms; one man can disconnect and tip it back against the cab out of the way so that any part of the hoist can be easily inspected.

This hoist employs the same gear principle used in the heavier units of the company. It will carry a 6000-pound pay load. Its simplicity of design with only two revolving parts makes it easy to inspect and repair.



The H-2 Heil Hydro Hoist and Heil Body Mounted on the New Chevrolet

TRUSCON CURB BARS

These specially rolled steel sections with their thick protecting faces are placed in the curb forms before concrete is poured and so become an integral part of the construction. They give to the curb a wear-proof, shockproof nose that is permanent assurance against cracking and chipping. Furnished in standard lengths of 8 feet, 10 feet and 12 feet and supplied bent to radius for corners.

The Complete Line of Truscon Products for Better Roads and Pavements

WELDED STEEL FABRIC for Permanence and Economy.

DOWEL CONTRACTION JOINTS for Eliminating Cracks.

STEEL ROAD FORMS for Accurate Construction.

RIB BARS for Supplementary Reinforcing.

CURB BARS for Protecting Curbs.

Our 184 page illustrated Hand Book "Modern Road Construction" free to Engineers and Contractors.

TRUSCON STEEL COMPANY, YOUNGSTOWN, OHIO

A Light Roller for the Small Contractor

A LIGHT, small roller, its weight varying from $1\frac{1}{2}$ to 2 tons, has been brought out by The Pierce Governor Co., Anderson, Ind. It is known as Model P-10 and is especially suited for construction jobs where the use of a large roller or a hand roller is impractical. It is small enough that it can be operated in close places where a larger roller would be useless. Included in its many uses are: rolling and packing crushed stone in roads, rolling concrete floors under construction, rolling drives in sub-divisions, rolling asphalt between street car tracks, rolling lawns, airports, tennis courts, etc.

The machine is made almost entirely of steel, both rolled and cast. All bearings are well lubricated. High engine efficiency is assured by the use of a Continental Red Seal motor, which requires about 4 gallons of gasoline for 8 hours' work.

Operation of the roller is simple. The operator has a clear vision front and rear of the roller. Steering is made easy by a worm steering gear operating in a worm sector. The double steering roller in front is easily controlled, going in either direction. The clutch, brake, gear shift and steering are the same as on an automobile.



The Light Pierce Roller on a Driveway Job

There is a 9-inch clearance between the frame and the ground, making it possible to roll up against the average curb, if necessary. The frame is narrow, and will permit rolling within 4 inches of a perpendicular wall.

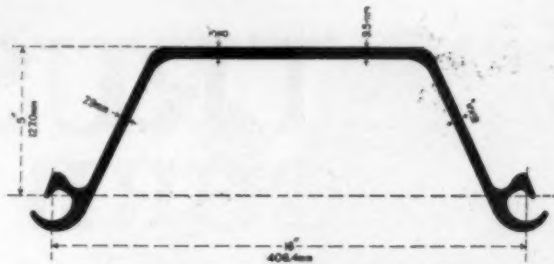
A small hand lever is provided on the dash of the power plant for the gas control. This lever connects directly to the Pierce governor, rather than to the carburetor. While the speed can be varied at will, the engine is always under governor control.

Simple, efficient scrapers are provided both at the front and rear of both rollers. The rear roller may be filled with water, sand, or iron borings to increase the weight. The drum holds approximately 1,000 pounds of water. Both front and rear rollers are chambered around the shaft to hold a liberal supply of grease.

The entire frame, front fork and arch are of steel. The Continental Red Seal motor runs at any speed from idling to 1300 r.p.m. Speed may be instantly adjusted as desired from the operator's seat. A hitch or pull ring is provided both at the front and rear of the roller.

A New Section of Steel Sheet Piling

AN addition to the line of Lackawanna steel sheet piling of the Bethlehem Steel Co., Bethlehem, Pa., is a deep arch-type section. This section is designated as Section No. DP165 and is characterized by the depth and shape of its arch construction.



The New Deep Arch Section of Lackawanna Steel Sheet Piling

Among the features of this new section are: nominal width of 16 inches; thickness of web $\frac{3}{8}$ -inch; weight per foot of pile 33.3 pounds; weight per square foot of wall 25.0 pounds; section modulus per foot of wall, single, 10.07, interlocked, 16.14.

The section is adapted for general use in types of construction where strength and light weight are of importance, and where the piling is to be used permanently such as in the case of bulkheads, docks, retaining walls, wharves and similar structures.

The interlock is of the double-lock type used in Lackawanna piling.

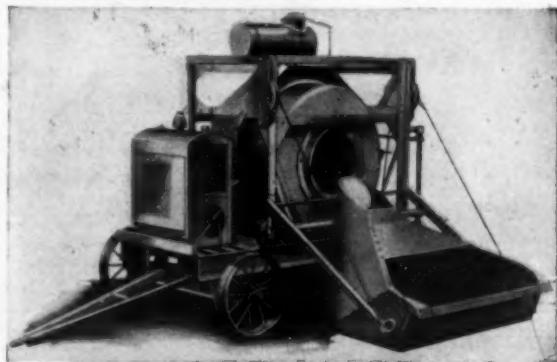
A New Non-Tilt Mixer

A NEW non-tilt mixer that requires no struts to stabilize it when at work, that comes to the job ready to work, and that will turn in a 20-foot radius, has been developed by the Construction Machinery Co., 447 Vinton Street, Waterloo, Iowa. This Wonder mixer is a compact and rigid piece of equipment and is equipped with the patented Wonderquick water tank which discharges the exact amount of water needed for each batch into the drum at the rate of 2 gallons per second.

The replaceable steel tires on the drum rollers take the wear as the roller track is deeply chilled cast iron, cast integrally with the ring gear. The rollers revolve on Timken tapered roller bearings.

Steering is of the compound automobile type, strong, rugged and permitting easy turning. Steel construction is used throughout. The mixing drum is constructed of pressed steel ends electro-welded to a heavy steel body. The frame is built of 7-inch channels while every other part of the mixer which is subjected to strain or torsion, is of steel. The all-steel skip is scientifically designed and is unusually wide.

The controls are all grouped at one end of the mixer so that the operator can view both the charging and discharging side without having to move. A knockout operates as the loader skip reaches its full discharge position at an angle of 55 degrees from the horizontal.



The Newest Wonder Non-Tilting Mixer

Beware the Flood!



Wide World Photo

AFTER THE ST. FRANCIS DAM BURST—MARCH, 1928

—Be Prepared!

ANOTHER FLOOD—this time a gigantic dam burst and a death dealing torrent of water poured down an unprotected valley, blotting out lives, destroying property—and carrying the potential danger of further loss of life through the pollution of water supplies.

And again, just as in the case of the Florida hurricane, the Mississippi flood and the New England devastation, the W&T organization offered its services and helped prevent the spread of disease.

A hurried dash to the flooded valley, a hazardous trip over washed out roads and undermined bridges—a toilsome portage of equipment and chlorine—its prompt installation to sterilize sewage that if permitted to be discharged untreated would imperil the health of those below.

The W&T organization, with strategically located offices, manned with trained sanitary engineers, equipped with chlorinators and chlorine, is always ready to serve in times of emergency.

But why wait for the emergency?

Every drop of your water supply should be chlorinated—always.

Chlorination costs but one cent per capita per year. It is the cheapest public health insurance—and the time to provide for chlorination is before the emergency comes.

Every water department—every health department, should have a portable W&T chlorinator and a supply of chlorine on hand to protect the public health.

"The only safe water is a sterilized water"



WALLACE & TIERNAN

COMPANY, INCORPORATED

Manufacturers of Chlorine Control Apparatus

NEWARK • NEW JERSEY



NEW YORK	CHICAGO	KNOXVILLE	SAN FRANCISCO	MINNEAPOLIS	PITTSBURGH	DALLAS	KANSAS CITY
LOS ANGELES	SEATTLE	ST. LOUIS	BUFFALO	HARRISBURG	INDIANAPOLIS	DETROIT	
WALLACE & TIERNAN, LTD., TORONTO, CANADA				WALLACE & TIERNAN, LTD., LONDON, ENGLAND			

SA 11

A Single-Cylinder, Vertical Engine

A VERTICAL-TYPE power unit that is compact, small over all and economical in operation has been produced by the Stover Manufacturing & Engine Co., 15 Lake Street, Freeport, Ill. It is a single-cylinder unit that develops 2 to 3 horsepower and is adapted to a variety of jobs in the construction field requiring an engine of this type.

The cylinder and frame case are integral and designed to



The New Stover Vertical Power Unit

provide water circulation for both cylinder and valve. They are honed, assuring a round cylinder and a well-fitted piston. The removable cylinder head, with large water space around and above the combustion chamber, permits the water to circulate completely around the spark plug. The hopper-upon-hopper cooled style of engine is extra large and provides ample cooling water for continuous running of the engine.

The piston is of gray iron, ground to size, and fitted with two plain and one wiper ring, the latter being provided to prevent excess oil from passing into the combustion chamber and developing carbon. The crank is drop-forged, machined, ground and well balanced and equipped with counter-balances.

The connecting rod is drop-forged of I-beam construction. The house is specially designed so that the enclosed unit can be placed in the smallest space possible. It is made of heavy gage black metal, with a side door to permit easy access to the engine. The fuel tank is located inside the house with a filling plug conveniently located on top.

New Departure ball bearings are used on the crank and cam shaft. The valves are completely enclosed and supplied with renewable guides. The governor is

of the horizontal centrifugal type automatically lubricated and with speed adjustment. The gears are of high carbon steel, heat treated and with wide faces, assuring quiet operation at all speeds.

The reduction drive is so designed that the power can be delivered from the cam shaft when so desired, which operates at one-half the speed of the crank shaft. In order to provide both fuel economy and efficiency in operation, the engine is provided with a hot spot, permitting the heat from the exhaust to vaporize the fuel before it is drawn into the cylinder.

A circulating specialized system of lubrication is used. A plunger-type oil pump, completely submerged, driven by the cam shaft, draws the oil from the reservoir through a screen and delivers it under pressure to the cam shaft bearings, timing gears and the enclosed governor parts. An especially designed breather equipped with a disc valve permits the engine to exhale only, preventing dust and foreign matter from entering the crank case.

Dual Wheels for a One-Ton Truck

DUAL, pneumatic wheels for the Chevrolet one-ton truck are being manufactured by Whitehead & Kales Co., Detroit, Mich. These Websteel wheels, as they are called, enable this unit to work out to maximum advantage on such work where the going is over soft ground, when extension frames are used with the truck, and where the loads are too great for a single tire.

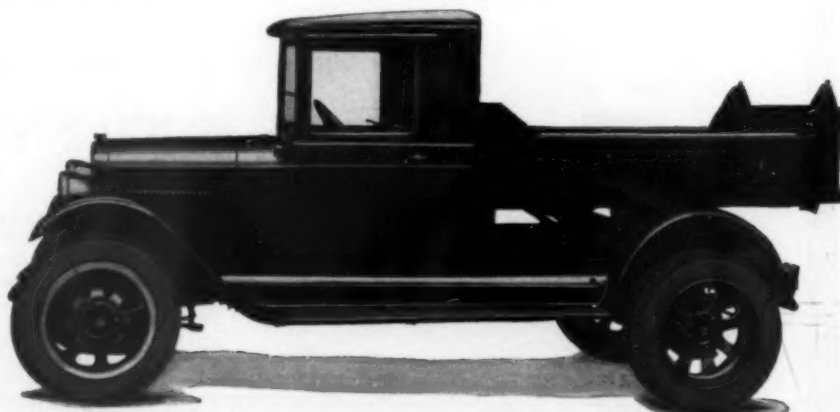
The open spoke design of these wheels permits air circulation for the brake drums and tires, and allows every part of the wheel to be readily cleaned. Open spoke construction, and tire-spacing also permit any type of chain to be easily and quickly applied.

All Websteel wheels are built to permit the application of standard makes of brakes. They can be used in either dual or single installations and will handle the following tire equipment, as specified: 30 x 5 single, 32 x 6 single, or 30 x 5 dual, 32 x 6 dual, 6.20 x 20 balloon dual.

Wheels are of the demountable type attached to the hub by four bolts and nuts on the front and eight on the rear. A standard tension locking flange is used. They are complete with hubs and brake drums and the standard Firestone DT tire locking ring. When the wheels reach their destination they are ready to be installed on the one-ton truck.

Where desired, Websteel wheels, interchangeable with rears, can also be furnished for the front. This company also manufactures change-overs for all makes of trucks.

These Websteel wheels are the result of concentrated effort to produce a steel wheel for pneumatic tires that would be light in weight, strongly built to stand hard usage, and of good appearance.



Chevrolet 1-Ton Truck Equipped with W & K Websteel Dual Wheels



"1862"

One of the earliest lines of
Cast Iron Pipe installed to
insure continuous service



This line runs across salt marshes.
It demonstrates the high resistance
of Cast Iron Pipe to corrosion.

After sixty-five years under these
conditions, the line shows not the
slightest sign of weakness anywhere.

Write for U. S. Cast Iron Pipe handbook. It
contains necessary data for construction engineers.



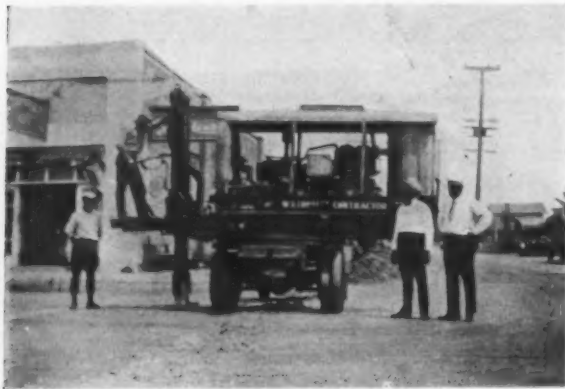
United States Cast Iron Pipe and Foundry Company

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Buffalo: 957 East Ferry Street
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Kansas City: 13th & Locust Sts.
& Hennepin Ave.

General Offices:
Burlington, New Jersey



The Rapid Pavement Breaker Showing Trench Opened and Machine Swung Around

A Heavy-Duty Portable Pavement Breaker

IT happens from time to time that pavements, whether built of portland cement concrete or black base, must be broken up for the installation of public service ducts or even for the construction of heavier paving to stand the ever-increased pounding of traffic. The Rapid Pavement Breaker Corporation, 1718½ Garfield Place, Los Angeles, Calif., has developed a practical pavement breaker that will smash even the best pavements quickly and effectively.

The machine consists of a 220-foot Chicago Pneumatic air compressor mounted on a Mack 3-ton truck to supply the power for the heavy pneumatic skull cracker that is mounted at the rear of the truck. The whole equipment turns on the truck, and the skull cracker itself swings to be able to deliver its blows at an angle when necessary. The machine is operated by two men, one to care for the compressor and operate the truck and the other to operate the breaker.

The manufacturers state that the machine will break out 500 lineal feet of pavement per hour in widths from 6 inches to 10 feet, the speed varying somewhat with the strength of the pavement. The machine weighs 5,300 pounds, and strikes a 500- to 15,000-pound blow at the rate of 50 times per minute, all under the control of the operator through the semi-automatic air-controlled valves. The breaker can be raised over a curb 18 inches in height.

A Big Capacity Earth Mover

A NEW, big capacity wagon grader for highways, streets, subdivisions, dams, reservoirs, cuts, fills and leveling has been produced by the Ball Wagon Grader Co., Wilson & Scotts Avenue, Stockton, Calif. This is a triple-bucket dirt mover that speeds up operations economically.

In the Ball wagon grader principle of operation, the depth of the bowl action is positive and constantly under the control of the operator, with simplified hand lever and ratchet. The bowls have been so designed with the proper tilt and shape, that dirt automatically fills the buckets full, crowding into the bowl



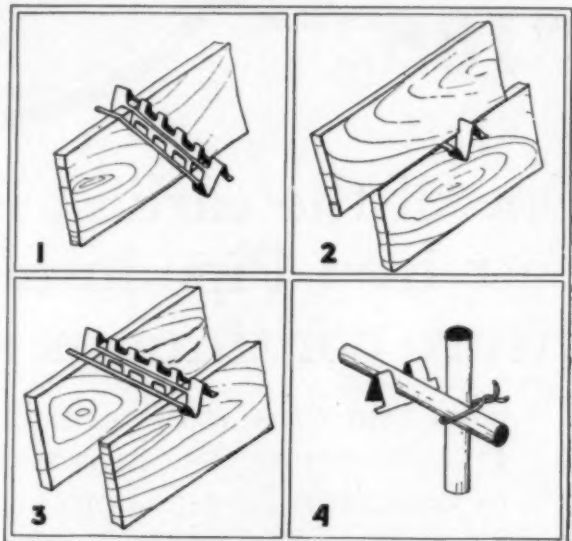
The Ball Wagon Grader

naturally. The easy loading of the grader, filling one bucket at a time by the simple operation of a single hand lever, means capacity loads, with minimum tractor power to fill the buckets.

Two loading and carrying buckets of 1-cubic-yard capacity each, operate automatically from levers under the operator's hand. Each bucket is 4 feet wide and has a crucible plow steel cutting bit which is easily removed for resharpening. A 7-foot long combination leveling and drag blade at the rear, behind the buckets, drags also one-half to 1 cubic yard of dirt and lifts and lowers by an easy-working hand wheel that limits the depth of the spread. This regulating feature is of great value in dam construction and highway and street work where spreading must be limited to very thin layers for rolling.

Once the dirt is in the bowl, power from a simple friction elevates the load, while a specially designed self-locking apron, operating automatically, holds the first in place as the bucket is lifted. By means of the hand levers which operate the buckets, the operator, without leaving his seat, can shake the bowls to clean them of wet or sticky soil. There is no loss of dirt from the buckets of the grader on the road to the dump.

Power to raise, lower, fill and dump buckets is simply transmitted from the rear wheels of the grader by steel link chains, which may be tightened or loosened on the friction drum. There are no gears or clutches to wear or give trouble. The grader with tractor can be turned on a 12-foot highway, and will work in any soil. It will scoop up its loads without any previous plowing or subsoiling except in extremely hard soils.



"Form-Hold" Form Ties Showing in 1 How the Tie Lays on the Board; 2, How It Locks the Boards in Place; 3, the Spacing of Boards and 4, the Manner of Holding Reinforcement Steel

A Metal Tie and Spacer

A FORM holder that is easy to handle and efficient, and reduces concrete form construction costs, has been put on the market by the Concrete "Form-Hold" Co., Inc., Culver City, Calif. This "Form-Hold" metal tie and spacer, according to the manufacturer, saves material for the contractor, while the saving in labor is approximately 50 per cent.

This form holder comes in sizes for 4 to 13-inch walls. Its features are: it eliminates wiring the forms; it holds the boards and reinforcing steel in place; it saves 50 per cent of the studs on one side by wider spacing; it eliminates studs entirely on the other side; it automatically spaces the form; it is easily and quickly placed; it enables the use of form boards several times; it maintains a uniform wall thickness; it also serves as a veneer tie, and it saves many hours on the job.

Framing Timber

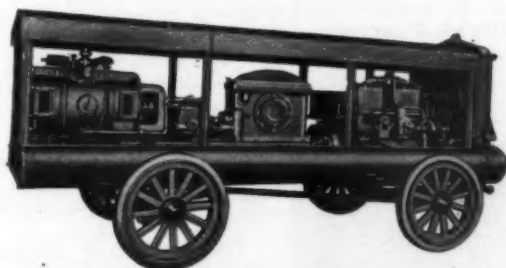
**The WOLF Portable
Timber Sawing
Machine**



50% SAVING IN LABOR
 is the report of W. D. Barkhuff, Supt., Streets
 and Sewers Dept., Seattle, Washington. Timber
 here is 12 in. x 12 in. and 8 in. x 16 in.
 Capacity 24 in. Available in air, A. C. or
 D. C. motor drive.

REED-PRENTICE CORP.
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THE RIGHT COMPRESSOR FOR ALL KINDS OF PNEUMATIC TOOL WORK



READY FOR EVERY JOB---

HORIZONTAL TYPE—DOUBLE
 ACTING—SLOW SPEED—
 STURDY AND RELIABLE—
 LONG LIFE—LOW UPKEEP.

THE TRAYLOR 12 in. x 10 in. PORTABLE COMPRESSOR

Will operate five rock drills, fourteen chipping hammers,
 or other pneumatic tools in proportion

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Also write us for information on
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 I would like to have your representative call. ☐
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 Address
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A Loading and Excavating Machine

A MACHINE for excavating and loading into cars, trucks, wagons, etc., known as Type-A, is being manufactured by the Schofield-Burkett Construction Co., Macon, Ga., and sold through The Mundy Sales Corporation, 30 Church Street, New York.

When the machine is applied to a pit-like excavation, the head works of the machine consist of a specially made triple drum hoisting outfit mounted in the rear of a timber or steel "A" frame, and carrying sheaves for supporting the hauling line cable, the return line cable, and the snub line cable. In front of the "A" frame is an incline connected to the "A" frame by two dumping skids.

In operating the machine, and beginning with the bucket in the field, the engineer throws in the friction clutch on the middle of hauling drum and draws the bucket towards him. The bucket is made with a sloping bottom at the back, and is equipped with the S-B patented automatic spring loading device which eliminates anyone being in the field of operation to trip the loading lever as was the case with the old model machines.

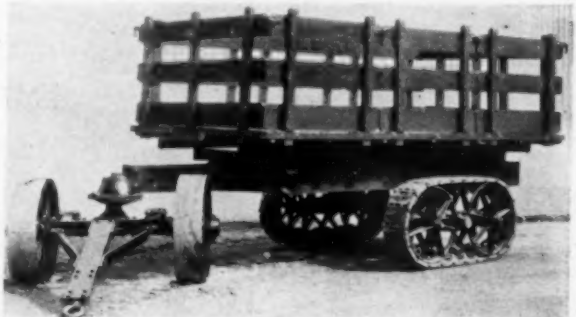
As the bucket moves forward the spring raises the rear of the bucket which throws the point into the ground, and when the weight of the load reaches the back of the bucket, the springs spread open and the point comes out of the ground. Across the rear of the bucket is the dumping bar, which projects out about 12 inches on each side, and when the bucket reaches the head or top of the incline in front of the "A" frame, the front end drops down between the dumping skids while the rear end is held up by the dumping bar resting upon the dumping skids. The simplicity of this mechanism renders the machine efficient in the hands of the most unskilled labor.

As soon as the load is discharged, the engineer throws the friction clutch on the back or return line drum to pull the bucket back into the field of operation. At the head of the incline is a roller, and when the strain comes on the return line, the bridle which is attached to the rear of the bucket pulls over this roller as a rope would over a pulley, raising the bucket up out of the dumping skids and letting it fall easily back on to the incline from where it is pulled into the field.

The snub block travels from one desired point to another on a track cable and is controlled by a cable attachment from the front drum of the hoist. By this arrangement there are no

ridges or ditches left in the field and the operator has complete control over the bucket at all times. The cut can be changed without loss of time and there are no bridles, rigging, etc., to be changed from one place to another by hand.

A special triple drum hoist is used on all the cable draglines of this company. The side frames make for all round sturdy construction. Machine cut steel gears are used throughout, and the silent chain drives can be furnished in connection with the electric and gasoline power units. A special oversized vertical boiler is furnished as standard equipment on the steam driven outfit to insure sufficient power at all times when running full speed. The two front drums have a line speed of 250 feet per minute, while the rear drum which hauls the empty bucket back into the field of operation after it has dumped its load, has a speed of 500 feet per minute. This feature enables the unit to give more maximum daily delivering capacity.



New Miami Platform Body Trailer with Creeper Wheels Which Carry Two-Thirds of the Load

A New Platform Body Trailer

A NEW platform body trailer that is constructed so as to carry two-thirds of the load on the rear creeper wheels and the other third of the load on the front steel wheels has been developed by The Miami Trailer-Scraper Co., 610 S. Clay Street, Troy, Ohio, and is known as Model CR-21.

The construction of this new piece of equipment is such that the fifth wheel can rock on top of the axle as the drawbar is hinged directly to the front axle. This allows the trailer to be

used with any make of tractor since any difference in height between the tractor and trailer in negotiating any uneven ground is adequately taken care of by the drawbar, and not by the frame of the trailer.

This construction eliminates all torque of the frame as the fifth wheel will rock on the front axle so that unevenness of the ground encountered by the front wheels is in nowise distributed to the chassis frame of the trailer. If one creeper wheel of the trailer mounts an obstruction, the frame merely tilts on the front axle without torque.

The platform body measures 6 x 12 feet. It can be furnished either with stakes or racks. The racks are built in removable sections to facilitate loading and unloading. The trailer can also be equipped with logging bolsters.



Type "A" Schofield-Burkett Machine Which Loaded 180,000 Cubic Yards of Sand and Gravel Without Being Moved, Its Cost of Putting This Sand and Gravel Into a Hopper Being 4 Cents Per Cubic Yard, Including Upkeep

American Steel & Wire Company's

WIRE FABRIC

"The Steel Backbone for Concrete"



Making City Street and Country Highway Permanent

TO reinforce concrete roads with Wire Fabric makes them permanent and is a proven economy. This fact is conclusively brought out in the report of the Highway Research Board, National Research Council.

Made of cold drawn high tensile strength steel, Wire Fabric has proved itself the perfect slab reinforcement. It gives the most effective distribution of steel—the closely spaced wires insuring greatest binding strength, holding the slab together as a solid unit and preventing the development of cracks.

Wire Fabric means permanent reinforcement—longer concrete life—lower maintenance costs. It is furnished in sheets cut to definite size which are easily handled and placed.

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.....Merchants Nat'l Bank Bldg., St. Paul	WORCESTER.....94 Grove Street
ST. LOUIS.....506 Olive Street	BALTIMORE.....32 So. Charles Street
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more water per dollar with BARNES PUMPS



Barnes pumps show their greatest value when operating under severe conditions. Their ability to operate steadily under high pressure when pumping through miles of pipe at varying elevations makes them a profitable investment.

Contractors whose profits have been dependent upon plenty of water for curing and other operations know that Barnes pumps give more water per dollar.

These features makes Barnes Pumps the choice of contractors who demand steady operation.

- 1—Most simple, self-oiling system one moving part rotary pump
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- 5—Roller bearings on all shafts, including crank-shaft
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The Barnes Manufacturing Co.,
905 Main St., Mansfield, Ohio.

Please send me further information about Barnes Water Supply Pumps.

Name

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City State



The New Austin Trencher No. 100

A New Small Type Trench Machine

A SMALL trench machine which will supply the needs of contractors engaged in digging shallow sewers and laterals, also for gas, water and pipe line work, as well as electric conduit trench, has been announced by the Austin Machinery Corporation, Muskegon, Mich. This machine will be known as the Austin Model-100 and is the result of accumulated knowledge of the Austin organization in the design and manufacture of larger trench excavating units.

A positive crowding of the boom while digging, a worm and gear hoist which locks the boom in any desired position, two digging speeds on the excavator chain, two speeds on the conveyor belt, and a compact design are the outstanding features. The digging width ranges from 16 to 30 inches and the depth from 4 to 8 feet. The overall length of the machine without the boom is 15 feet and the overall width 7 feet. It will dig 9 inches from curbs, etc., and is crawler mounted. Cut gears operating in an oil tight housing, provide 3 forward and 3 reverse speeds. The boom is of 1-inch steel channels carrying cast steel buckets having lips and bucket hangers cast integral. Lubrication is by the Alemite system.

A Shifter for Narrow Gage Track

THOSE who have narrow gage track to shift and raise will welcome the announcement of the Nordberg Manufacturing Co., Milwaukee, Wis., of a new Model "O" track shifter, a machine that can now be procured for use on track as narrow as 36-inch gage. This company for the past three years has been building a standard gage machine.

The principle of operation of the Model "O" is the same as that of the standard machine. Due to a less severe service and smaller dimensions, it has been possible to simplify the controls and decrease the weight in comparison with the larger



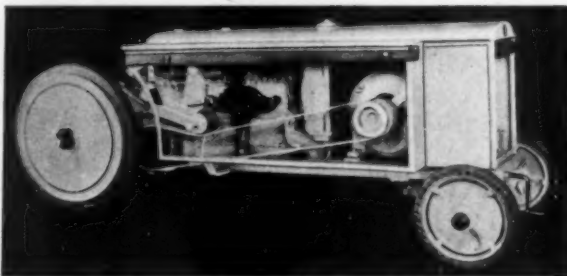
The New Nordberg Narrow Gage Track Shifter

machine. It is powered by a 4-cylinder, 15-horsepower, fully enclosed gasoline unit. There are two propelling speeds in either direction—a low of $4\frac{1}{2}$ miles and a high of 13. The worm-driven lifting speed has a lifting capacity of 42,000 pounds at a maximum lifting speed of 15 feet per minute. The frame is made of 8-inch channels and all the joints are welded. It has a width of 5 feet 5 inches, length of 12 feet 1 inch, and a wheel base of 5 feet 5 inches.

Power for the various functions of the machine is supplied through friction disc clutches. Any clutch to be in service must be held in by the operator—that is, when the clutch is released, it is automatically disengaged. This arrangement permits a much faster performance as it enables the securing of greater accuracy in the various movements of the machine when shifting and raising track.

While this machine is principally for shifting work, it can also be used for raising track by lifting one rail at a time. This dispenses with the jack gang and greatly speeds up any track raising job.

At quarries, open pit mines, construction jobs, or any place where narrow gage track must be shifted and raised on waste dumps and fills, this new Model "O" track shifter will equal the performance of its larger companion machine, the Model "N." The operator and several laborers will replace the usual track gang, resulting in saving labor and faster work.



A Fordson Tractor Equipped with the New General Electric Welder

A New Welder Tractor Combination

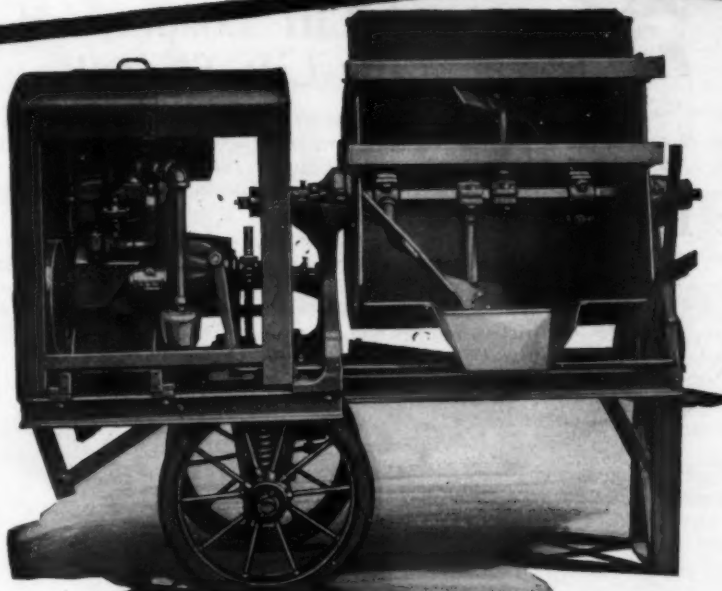
AN improved combination of electric arc welder and Fordson tractor has been developed by the General Electric Co., Schenectady, N. Y. Substitution of a new type of welding equipment and the addition of head and tail lights and a protective cover constitute the principal improvements.

This equipment consists of a standard Fordson tractor, belt-connected to a Type WD-300-A, 25-volt, 300-ampere one-hour rated 1750 r.p.m., ball-bearing generator. The unit is mounted directly on the tractor and is protected by a metal canopy and canvas side curtains. Other equipment includes governor, power take-off, muffler, waterproofed pulleys on engine and generator, belt and belt tightener, industrial (disc-type) rubber-tired wheels front and rear, extension frame, off-set crank, control panel and reactor, head and tail lights, and battery and charging control. Optional equipment includes: light industrial (spoke-type) wheels front and rear; Fordson farm wheels front and rear, and any other desired accessories.

The overall length of the complete unit is 12 feet; the height is 4 feet 8 inches; the width is 5 feet 2 inches, and the net weight is approximately 4,900 pounds. The battery, which supplies current for the lights and ignition, is charged while the welding generator is operating. It is provided with ammeter and automatic cutout. For field use, the unit will haul equipment and tools to the job and then supply welding current for the work.

This outfit has been designed particularly for hard, continuous use, and the utility of the tractor as a hauling device has not been impaired.

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Write today! For the new **BLYSTONE Circular**

BLYSTONE MFG. CO., Cambridge Springs, Penna.

Phone Walnut 1630

F. A. WEAKE, INC.

Contractor for
PLAIN AND DECORATIVE PLASTERING
293 Bridge Street
Springfield, Massachusetts

February 22, 1927.

Blystone Manufacturing Co.,
Cambridge Springs, Pa.

Gentlemen:

In reply to your letter of February 19th in which you ask us just what we think of the Blystone Plaster Mixer you sold to us a year ago.

We are very pleased to say this machine has given us A-1 Service. We have kept it in constant use and the results have been very gratifying as this machine paid for itself on the first job. This machine has done more than you claimed for it.

Yours very truly,

F. A. WEAKE, INC.,

By: F. A. Weake.

FAW:RN

The Simplest Way To Move Dirt—

You may think of a grading job as a big bunch of scrapers or wagons or trucks being loaded one at a time, amidst a lot of confusion.

Now think of a Baker Maney job, moving just as much dirt, with only two men, sometimes three, on the job. One train of scrapers with a tractor doing all the work—the digging, loading, hauling, dumping, spreading and compacting. Simplified earth-moving at a cost you can't afford to ignore.

BAKER MANEY
Self Loading Scrapers



Baker Maney's made in two sizes, Model D, $1\frac{3}{4}$ -cu. yd., Model H, $\frac{3}{4}$ -cu. yd. For short hauls consider Baker One Man Automatic Rotary Scrapers.

Use the Coupon

The Baker Manufacturing Co.

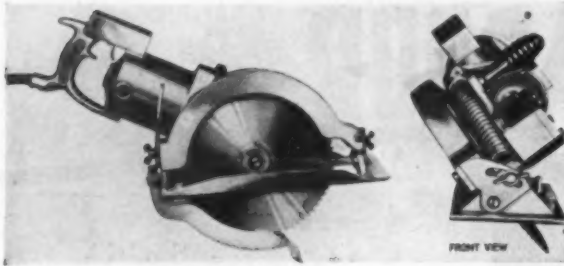
585 Stanford Ave., Springfield, Ill.

Send literature and prices on items checked ☐ Baker Maney Scrapers

☐ Baker Rotary Scrapers

(Name)

(Address)



Side and Front Views of the Wodack Portable Electric Hand Saw

A Portable Electric Hand Saw

A NEW portable electric hand saw, Type-B "Wodack," which, in addition to vertical sawing, provides for bevel sawing at any angle up to 60 degrees is being produced by the Wodack Electric Tool Corporation, 4627-4629 West Huron Street, Chicago, Ill. A width gage for vertical sawing, which can be set for any width up to 6 inches is another feature.

These two features will prove great time savers for contractors in the cutting of roof rafters and concrete form work. Bevel sawing at any angle up to 60 degrees is accomplished by a tilting saw-base which can be set and locked at any angle within this range by means of a slide and locknut. With the width gage, various widths of strips can be sawed without the necessity of marking and with greater accuracy and uniformity.

Like other "Wodack" types, the Type-B has a General Electric universal motor of special design which operates on both A. C. and D. C., and is furnished in 110-volt, 220-volt and 250-volt. The saw is furnished complete with one 11-inch and one 9-inch blade ready for use.

New Leaning Wheel Graders

TWO new E-Z Lift leaning wheel graders, Nos 77 and 78, and important improvements in their larger sizes, Nos. 10 and 12, are announced by The Galion Iron Works & Manufacturing Co., Galion, Ohio. The two new graders are smaller, lighter machines, equipped with 7- and 8-foot mouldboards, respectively. They have all the good features of the larger machines, including the Simplex pivotal frame adjustment and E-Z Lift gearing.

Some changes have been made in the E-Z steer assembly for this size grader, although the self-locking machine-cut worm gearing operating in oil in an oil-tight gear case is used. Operation of the steering device is easy and positive.

On the larger machines, the big, enclosed lift springs have been placed down out of sight between the frame members. Some slight changes have been made in the placing of the operating wheels and cranks, and minor changes have been made in the steering gear.



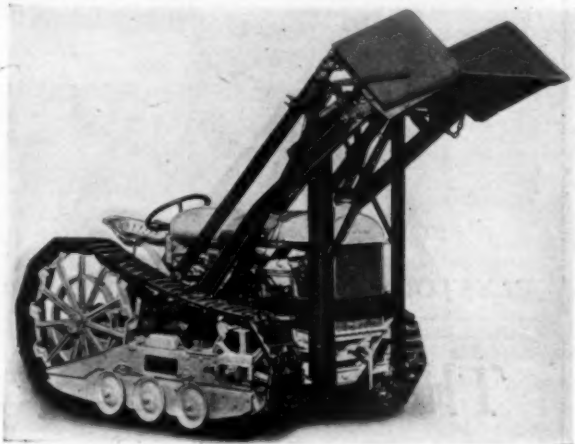
The New Galion No. 12, E-Z Lift Leaning Wheel Grader

Perhaps the most important change of all is in the "bottom," as the blade and circle are called. The former cast steel full-circle proved satisfactory, but the new semi-circle is equally as good or better, and its use has permitted a reduction in weight which makes handling easier than ever.

A High-Lift Loader and a Low-Lift Shovel

AN improved high-lift loader and an improved low-lift shovel have been recently developed by the Lessmann Loader Co., Des Moines, Iowa. New improvements and features make these machines desirable equipment for contractors and road builders.

Among the improvements is the substitution of steel for malleable iron in many of the parts, thus generally strengthening the machines. Other changes include an improved clutch, cable tighteners which insure even hoisting of the bucket, anti-friction bearings, and an extra-long pinion shaft bushing of high



The New Lessman High-Lift Loader with Trackson Full-Crawler Tread

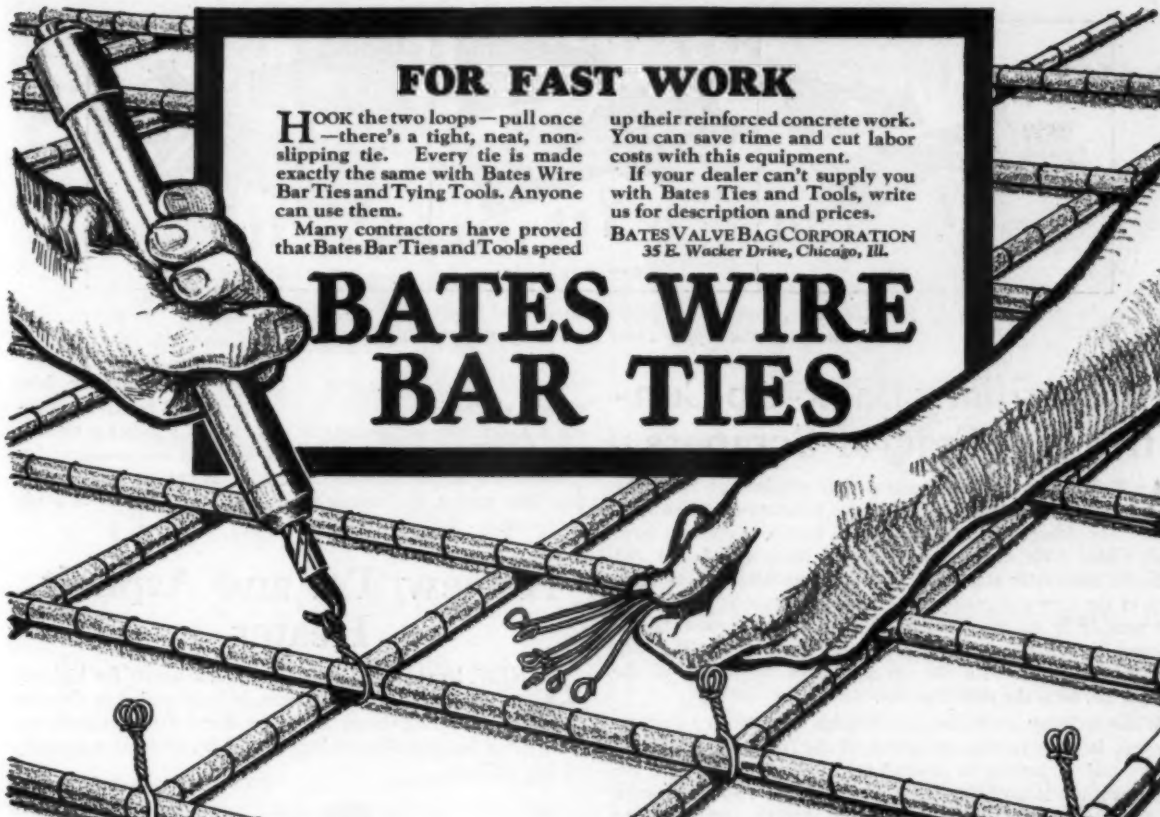
grade bronze. The mechanical principle of the Lessmann loader has been retained in the new loader and shovel, since it has demonstrated its efficiency in operating a loading or digging device.

With this new machine the strain of lifting does not all come at the front of the tractor, but instead, much of it comes at the pivot point of the lift, which in the case of this machine, is at the center of the tractor. This feature not only means less strain on the equipment, but also insures greater efficiency and better balance, and greatly reduces the tendency of the tractor to rock or pitch forward when the bucket is loaded.

IDLE EQUIPMENT MEANS LOST MONEY

Every time it is necessary to replace a wire rope, the machine involved is temporarily "non-producing."

The longer a wire rope lasts the less non-producing time there will be, and it does not take very much idle time to offset a lot of first-cost saving. Steady performance not only cuts down operating cost but it also speeds up production, thereby increasing profit in two ways.



FOR FAST WORK

HOOK the two loops—pull once—there's a tight, neat, non-slipping tie. Every tie is made exactly the same with Bates Wire Bar Ties and Tying Tools. Anyone can use them.

Many contractors have proved that Bates Bar Ties and Tools speed up their reinforced concrete work. You can save time and cut labor costs with this equipment.

If your dealer can't supply you with Bates Ties and Tools, write us for description and prices.

BATES VALVE BAG CORPORATION
35 E. Wacker Drive, Chicago, Ill.

BATES WIRE BAR TIES

Even your Smaller Machines ~ are profit makers only when actually at work

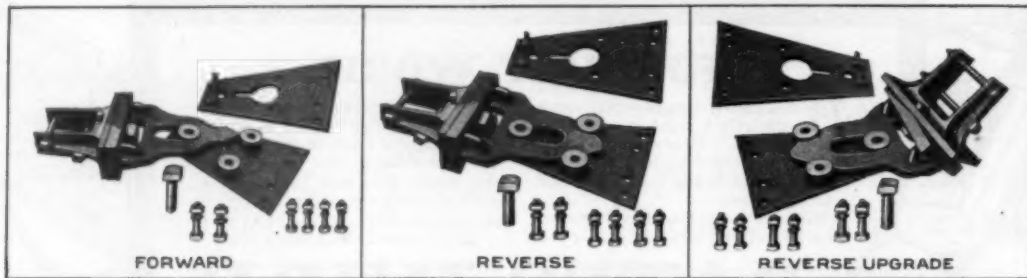
The time spent on the road between jobs, no matter what the size of the machine, is unprofitable. Highway Machinery Trailers reduce each of these profitless periods by hours. Highways are made in several types and in sizes ranging from 1½ tons to 75 tons.

Write for Details

**HIGHWAY
TRAILER CO.**

Edgerton, Wisconsin, U. S. A.





Action of the Schaefer Auxiliary Back-Up Control for Tractor Scrapers Under Varying Conditions and with Upper Plate Removed to Show Interior Action

An Auxiliary Back-Up Control for Tractor Scrapers

AN auxiliary back-up control that requires no operating levers nor adjustments has been developed by The Gustav Schaefer Wagon Co., 4180 Lorain Avenue, Cleveland, Ohio. This lock is designed for Models 264 and 265 Schaefer automatic tractor scrapers and provides universal action in the forward position. When the tractor is backed up, the scraper is automatically locked so that it cannot buckle sidewise, but must remain in line with the tractor. The lock does not interfere with the up and down movement of the scraper nor with the swivel action.

While ordinary work does not require the auxiliary back-up control, it adds to the usefulness of the scraper in crowded places and in getting in around trees, obstructions, etc., because when it is used the tractor does not have to make loops or turns to get the scraper into the desired position. The scraper may be operated backward and forward in shuttle fashion, which saves time, especially on cellar excavations, backfilling, etc.

A New Electric Hammer

ANEW electric hammer that strikes 2,300 sharp, hard blows a minute has been put on the market by the Black & Decker Manufacturing Co., Towson, Md. It weighs 15½ pounds, and comes in a compact kit with compartments for chucks, turning wrenches and drills.

While ordinary work does not require the auxiliary back-up hammer and bull point strikes 50 or 60 more or less effectual blows a minute, the economy in time and money afforded by the use of this electric hammer is a deciding factor for its application in construction work. Actual records of the manufacturers show that it will cut a stairwell 3 x 10 feet in a 12-



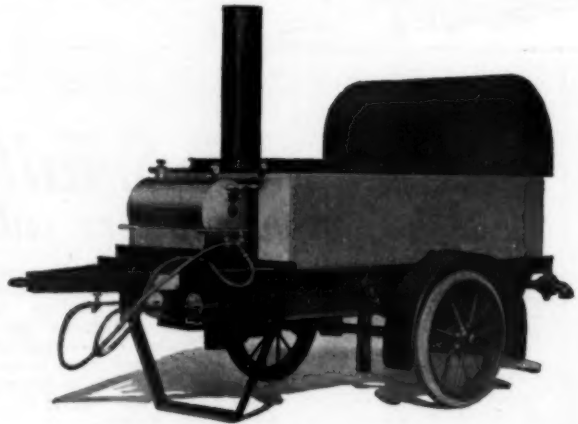
A Black & Decker Electric Hammer Opening Up Concrete for Conduits

inch reinforced concrete floor in 8 hours—1300 holes for theatre seat expansion bolts 9/16 x 2½ inches in 18 hours, hammering a 1-inch hole in concrete at the rate of 3 inches a minute, or in brick at the rate of 8 inches a minute.

Operation of the hammer is simple. It can be plugged into any light socket, the switch pulled, and the hammer is ready for work.

A New Tar and Asphalt Heater

ANEW, large capacity tar and asphalt heater for highway maintenance work has recently been added to the line of Littleford Bros., 485 East Pearl Street, Cincinnati, Ohio. It is an exclusive oil burning model, and has a capacity of 300 gallons.



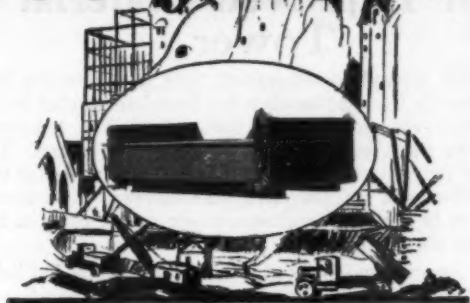
The Newest Littleford Tar and Asphalt Heater

This unit is particularly adapted to several repair jobs that are scattered and have to be taken care of quickly, since the kettle can be loaded before starting for the first job and then moved rapidly from job to job without the necessity of constantly recharging as must be done with smaller kettles. It can be used on jobs where large quantities of material are required, such as skin patching and shoulder work, also on small jobs such as repairing holes, filling cracks and expansion joints, etc.

Heat is supplied by two Littleford torch burners. Sil-O-Cel insulation in the bottom of the combustion chamber prevents the heat loss and increases the efficiency of the burners. The rear section of the cover is hinged and when closed forms a warming hood under which barrels may be drained.

The running gear is built for high speed, having semi-elliptical springs, high carbon steel axles, and rubber-tired wheels with Timken bearings. Steel guards protect the tires from the heat of the kettle.

Serving Industry Everywhere



The Wood W-8 All Steel Body

The body must be right; makeshifts will not do. That is why we have developed dump bodies as mechanically perfect as we can build them. They must measure up to our critical requirements before they are placed in actual service. In short, they are made to stand the "gaff."

The Wood W-8 type steel dump body is constructed of No. 8 gauge steel. All joints are hot riveted. It has straight sides and square corners.

The front end and tail gate are extended above the sides, so body capacity is easily increased by use of extension side boards. The double-acting tail gate, to hinge from top or bottom as required, when lowered to horizontal position forms an extension of the floor of the body. Chains and pins are provided to hold tail gate in any position desired.

Wood Dumping Equipment serves industry everywhere building construction is in progress, everywhere good roads are being built, everywhere material is being hauled and dumped.

Write for catalog

WOOD

HOISTS-BODIES

Wood Hydraulic Hoist & Body Co.
Detroit, U. S. A.

Where are you?



Digging sticky clay in New Orleans; the owner reports that this WILLIAMS has proved "an unequalled digger"

Williams Buckets can be seen at work everywhere—successful in the hardest service

WHETHER you are digging hardpan in California, gumbo in Texas, coral rock in Florida, stiff clay in New York State—

■ We can put you in touch with contractors who report: "Bigger outputs with our WILLIAMS Buckets than with any others we have used."

■ The WILLIAMS [Power Arm combines the lever and block-and-tackle in the one way that gives a straight line closing pull. It builds up the needed digging power with a shorter cable overhaul—and without the slightest "side lead."

The WILLIAMS is all [bucket—"Built to Dig, and Last While Digging." Extra steel is built into the scoops, where it adds to the bucket's durability as well as its digging power.



WILLIAMS "Double-Arch" Dragline—you'll never see the sides of this bucket drawing in

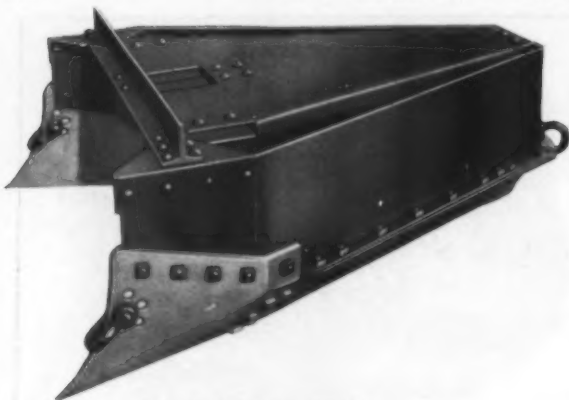
Write for our free Bucket Book, showing photos of WILLIAMS Buckets on the job—and giving the reports of contractors using them.

G. H. WILLIAMS COMPANY
609 Haybarger Lane, Erie, Pa.

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WILLIAMS

FAST-DIGGING BUCKETS



The Garst Power Scraper

An Economy Power Plow Scraper

A POWER plow scraper that allows a large output of material by a force of one or two men and that moves the material distances up to 400 feet without moving the point of delivery is opening up a new field by its economy of operation. It is being manufactured by the Garst Manufacturing Co., 549 West Randolph Street, Chicago, Ill. It reduces to a minimum the amount of dead weight that is carried with each yard of material handled. It is for use in either hard clay or in loose soils, such as sand and gravel deposits.

This scraper is essentially a right- and left-hand plow joined at the rear and having a vertically adjustable cover plate which stops all over-digging and can be adjusted to increase or decrease the normal capacity.

The plowshare front ends are removable so that different shapes can be used in different soils. These and the back wearing plates are made of special steel castings. With this construction, teeth are seldom necessary because the scraper is so constructed that it naturally digs in.

The plowshare end is formed by flattening out the V-shaped side walls. It is made of special alloy steel, since it stands most of the digging wear. It is attached to the scraper by 11 bolts. The length of the scraper varies from $1\frac{1}{4}$ to $1\frac{1}{2}$ times its width. The side walls are at an angle of 26 degrees with the direction of pull, which is the angle at which the earth is cut by the shearing action. The length of the scraper overcomes the tendency to swing.

The vertical side walls make the scraper easy to dig. They correspond to the mound-board of the plow, and the vertical shape has proved its efficiency because the earth, as it is dug, is very little retarded by its direction up the side of the scraper. The vertical side walls also allow the vertical adjustment of the coverplate.

The coverplate is the only movable part of the scraper. It is adjustable both up and down from the normal condition, which is flush with the top of the side walls, and gives a 50 per cent change in the load of the scraper from normal. It is held securely by at least 8 bolts with a 4-point suspension. The adjustment angles are underneath the "T" bar. This feature fits the scraper to meet various conditions, such as change of power and of line pull. It prevents overdigging.

An important part of the scraper is the strong brace construction at the top of the front end. To overcome the tendency of the scraper of the V-type to collapse inwardly, a heavy "T" bar running straight across the front end of the scraper is placed and attached to the parallel side walls by a gusset.

The bottom or cutting edge of the scraper is attached to the upper plate by a flange joint which runs entirely around

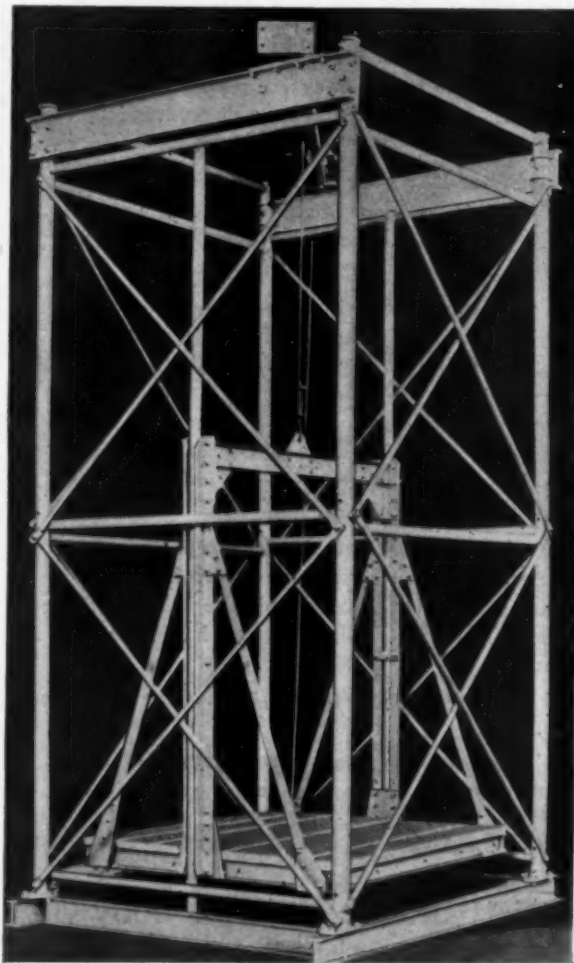
the scraper, removing all bolt holes from the inside surface. It is held by bolts which are very accessible, and with this construction the entire bottom wearing plate can be easily removed.

An Improved Material Tower

A NEW method for eliminating nuts and protecting bolt threads from the weather, has been incorporated in the new 1928 pipe material tower which The Lakewood Engineering Co., Cleveland, Ohio, has put on the market. The cages for this steel tower are built in two sizes; one for two wheelbarrows and one for three wheelbarrows. An elevator bucket can be used for handling concrete on the material elevator cage when desired.

These towers have few loose pieces. They require few bolts, no nuts, and have all intermediate section bolt threads protected from the weather. These features insure easier erection and dismantling and greater salvage and easier warehousing.

Standard towers can be built to a height of 300 feet, either single or double cage and can be increased in height to 400 feet by the addition of 100 feet of extra heavy section. Figures taken from actual jobs indicate that the single cage towers can be erected at a cost of one-half man-hour per foot and the double towers at a cost of one man-hour per foot, with fairly efficient labor.



The Lakewood Improved Material Tower

The "GROUNDHOG"

The Scraper with POSITIVE LOADING CONTROL!

Made in 4- and 5-
foot widths, capaci-
ties 3/5 yard to 1
yard

For use with
Cietrac "K"
Fordson
Caterpillar
(2-ton)
McCormick-
Deering
etc.



NO stalling, no overloading with this scraper. The long loading lever enables the user to take as deep a "bite" as he wants, and to stop loading instantly. Its action is easy, quick and positive.

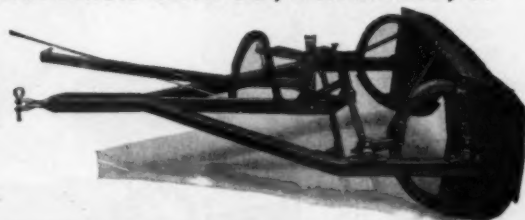
And it's as easy to dispose of the load as it is to get a load. Simply pull the trip rope and the bowl revolves to spread or dump the load as desired. Another pull on the rope, and the bowl returns to loading position again. No stopping, no backing; it loads and spreads or dumps continuously under forward draft. The fastest, most satisfactory scraper you ever used!

*Write for full information and
name of nearest distributor*

THE RODERICK LEAN CO., MANSFIELD, O.

Left:
The load can
be carried
any distance

Right:
Spreading
position



THE UP-TO-DATENESS OF THE BUFFALO- SPRINGFIELD



*Scarifiers and other spe-
cial attachments optional*

accounts for the nation-wide preference of street and road builders for this particular make of equipment. That this preference actually does exist all over the country may be verified very quickly by anyone inclined to make a survey of the roller equipment in use in his particular section of the country.

Buffalo-Springfield jobs are designed to meet all sorts of conditions and are built in many models and sizes.

Illustrated literature ready to mail

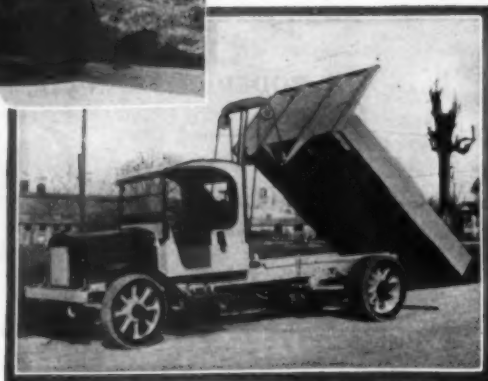
The BUFFALO-SPRINGFIELD ROLLER CO.,

Springfield, Ohio

A Truck Body Built to Handle Boulders

FOR use where the ordinary body will last about ten days and the ordinary tail gate about ten minutes, that is, in heavy rock excavating, the Pacific Coast factory of the Wood Hydraulic Hoist & Body Co., Detroit, Mich., has designed and built what is known as a "boulder body."

Extra strength is built into the parts of the body that must bear the brunt of terrific impacts when huge boulders are



The New Boulder Body Built to Be Pounded

dropped from a bucket of a steam shovel. There are a large number of reinforcing body cross members and the sides slope in to keep the boulder from rolling off the truck. These slanting sides are also reinforced by additional structural steel cross members and will stand the most severe shocks and strains.

A New Size Pneumatic Digger

A NEW pneumatic digger has been developed by the Ingersoll-Rand Co., 11 Broadway, New York, to meet the demand for a more powerful light-weight tool. This new tool, size 73, has great power for its weight, and has a new type of construction.

In its construction, a self-seating plate valve of the "flapper-type" is used, which gives a smooth and positive action, and is so constructed that it actually seats tighter with use. The light weight, small travel, and cushioned action of the valve make wear negligible.

The tool-retaining device is also of a new construction, designed to completely enclose the lower end of the barrel, thus keeping dirt from working up, to support the lower portion of the shank of the blade, and to make possible easy assembly and removal of the rubber buffer and blade.

Two types of handles are furnished: an open-type outside trigger handle, which is standard, or a closed-type inside trigger handle. The handle is bolted to the barrel giving a secure construction and one which can be easily disassembled and assembled. Especially suited for tunneling



The New Size I-R Pneumatic Digger

in clay and for similar work, the extra power of this tool, combined with ease of handling, makes possible an increased rate of work. The length of the stroke is 2½ inches; the length overall, without clay scoop, is 20½ inches.

Wholesaler Merchandises Lumber by the Package

A UNIQUE plan to sell lumber in labeled packages has been announced by the Weyerhaeuser Forest Products, Merchants National Bank Building, St. Paul, Minn. Five important results from this packaging, labeling and guaranteeing lumber, so far as contractors are concerned, are: abolishing the time the mechanic takes to square up every piece by hand before using it; eliminating many abuses from lumber construction; increasing the demand for wood house-construction by improving its quality; protecting the legitimate contractor from the bidder who takes work so cheaply that he has to substitute inferior materials and otherwise "skin the job;" enabling the contractor to merchandise the lumber-built house on a quality basis.

The better grades of square-edged finishing lumber that are being remanufactured and will bear the label of this company include, at present, all square-edged finish, beveled and Colonial siding, drop siding, softwood flooring, both standard and end-matched, ceiling, and a wide variety of mouldings.

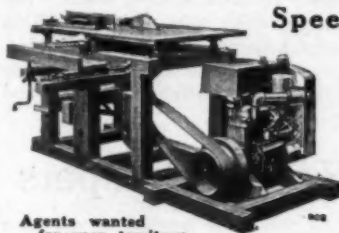
Each piece is retrimmed so that both ends are smooth and four-square. Three to twelve pieces, depending on the kind, are placed together, with the faces turned in for protection, and the package is adjusted. This consists of a pair of end-caps of the strongest sulphate fibre known, which fit over each end of the bundle. These caps operate on a combination of the sleeve and hinge principles, so as to allow for the

shifting of the boards as the package moves over a loading jack or goes through any of the other motions of handling. They bear a label on which is printed the brand-name, "4-Square," the grade and species of the contents and the name of the individual mill at which it is produced.



Loading "4-Square" Lumber from Freight Car to Trailer

To the architect, this new plan means assurance that lumber of the quality, species and grade he specifies is used. To the owner, it assures the use of quality products if he is willing to pay for them. Against the higher price, it balances a saving in cost.



Speed up work this WAY

Save time by taking your shop to your job. The American woodworker performs 14 woodworking operations. Four men can work at it at once. Write for details of this and other cost-cutting machinery.

Agents wanted
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AMERICAN SAW MILL MACHINERY CO.

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Why protect your job with a piece of tin?

McCLOSKEY Bomb Shell Torches are made of heavy steel — indestructible — reliable — economical — used by States, cities and contractors everywhere.

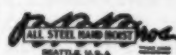
If your dealer cannot supply you—write to us for circular.

McCLOSKEY TORCH CO.

Spitzer Building

Toledo, Ohio

Patented in U. S. A. and Canada



"The Strongest Geared Power
for Its Weight in the World"

Capacity
5 Tons
Straight
Line

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POSITIVE
INTERNAL
BRAKE

Weight
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Size
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high

Two Speeds
4 to 1
24 to 1

Write for description
circular with users' en-
dorsements and name
of nearest dealer.

Price \$80 F. O. B. Warehouse Points,
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"TEN TIMES MORE LIGHT"



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lantern, and at less cost"—

This remark by a railroad man ex-
plains why thousands of National
Carbide Lanterns are being used
today by contractors, miners, tun-
nel workmen, street repair crews,
and others who want a dependable,
strong, clear and penetrating light.

NATIONAL CARBIDE SALES CORP.

342 MADISON AVE., NEW YORK



The New Monarch 10-Ton Model-F Tractor

A New 10-Ton Tractor

RETAINING in general all of the power advantages which have characterized the 10-ton tractor of the Monarch Tractor Corporation, Springfield, Ill., a new 10-ton Model-"F" is now being produced by that company. Some important improvements and new features have been incorporated in the new tractor, including heavy structural main frame, a new type of transmission case, oil-tight chain housings and an entirely new design of truck roller frame and track assemblies. The over-all height has been slightly reduced, and the over-all width increased. The tractor is rated at 59 drawbar horsepower, but develops a maximum of 78. The weight remains 21,500 pounds.

The change in the transmission is only in the shape of the case itself; master clutch and steering clutches, and the heavy-duty 4-cylinder LeRoi-Monarch valve-in-head engine, fully enclosed, having been retained. A flexible connection is provided between the master clutch and the transmission, and the arrangement is such that the master clutch may be removed as a unit, without in any way disturbing other parts. New Departure ball bearings of extra large size are employed throughout the transmission. All gears are of cut steel, hardened and run continuously in oil. The gear set is of selective sliding gear type, three speeds forward and reverse. By changing two chain sprockets, optional road speeds are available.

The roller truck frames are of entirely new design, and are pivoted on the rear axle, which is of chrome nickel steel, 4 inches in diameter. The side channels of the truck frames are unusually heavy, riveted, trussed and graced to provide the necessary strength and rigidity for the most difficult operating conditions.

The five truck wheels on each side are of the improved heavy-duty type, comprising cast hubs with drop forged steel rims and turning on large Hyatt roller bearings, with inner and outer races. The 10-ton tracks are of new and distinctive type, being built entirely of manganese steel. The rail and shoe are cast integral, and all of the parts of the track links are held to close tolerances, thus permitting of close driving fits in the assembly of the pins and bushings into the track links. The rails are extra high and wide, with openings in the sides. In connection with the special sprocket tooth design and the roller, there is no clogging of the truck in sand, mud or snow.

The new truck roller frame design enables the final drive chains to be enclosed in oil-tight and dirt-proof housings. The chains are of new extra heavy type especially designed for this service, being made of alloy forged steel, heat treated.

Special consideration has been given to the operation of the tractor. The steering column is

of truck-type with large easily operated steering wheel. The master clutch lever, located for either right or left, is within convenient reach as are the brake pedals, which assist steering. The throttle lever is on the steering column, and at the base of the column are located the ignition and lighting switches and the electric starting button.

One-Man Rotary Scrapers

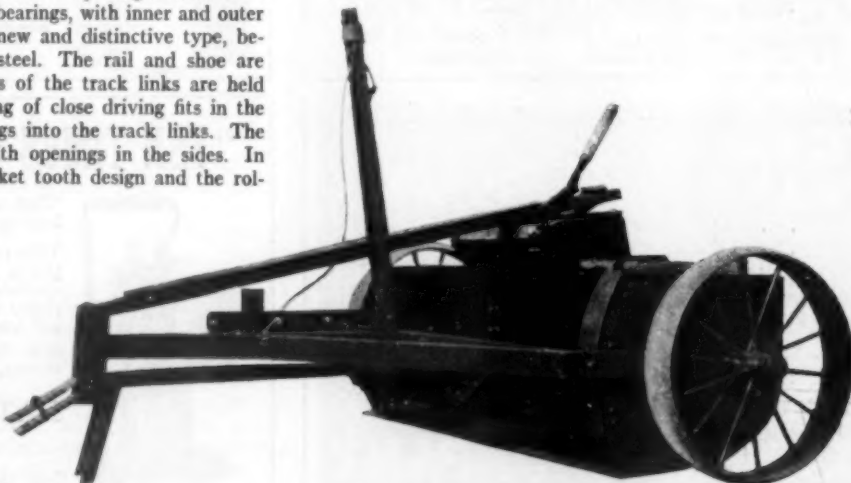
ROTARY scrapers that are easily handled by one man with tractor or horses and that may be used with or without wheels are being manufactured by the Atlas Scraper Co., Box A-1, Bell, Los Angeles, Calif. These scrapers are of simple and rugged construction, and are easily and completely under the control of the tractor driver or teamster at all times. They cut to the depth wanted, and can be forced to dig even hard, unbroken ground. They will dump in a pile or spread as thin as desired.

Operation of these scrapers is not difficult. The pull being at the forward end of the link tends to throw the tilting lever and control arm backward. This force is so balanced that an easy pull on the tilting rope will bring the tilting lever and control arm forward. They are held in the required position by the latch, which is also operated by the tilting rope. This rope goes from the latch over a pulley in the tilting lever to the operator.

On the bowl are three bars, which hold the bowl in the load, spreading or riding position when held between the stop and pawl of the control arm. When in the load position an easy pull on the tilting rope will force the blade to cut to the depth wanted. When released the blade stops digging. As ordinarily used, part of the load is pushed ahead as with the drag scraper, but to carry a bowlful clear of the ground it is only necessary to load and then back up to tilt the bowl into the riding position.

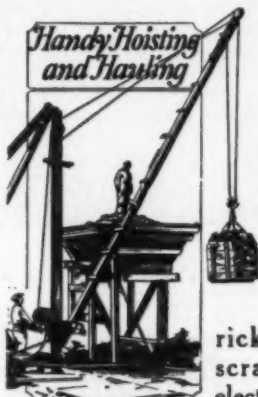
When ready to release the load, a pull on the trip rope forces the stop free of the load bar, and the bowl will turn until the spreading bar comes to the stop. To dump in a pile hold the trip lever forward until the spreading bar has passed the stop, or when the load has been spread pull the trip and the bowl will revolve until the riding bar comes to the stop.

When riding either loaded or empty, the weight is all on the wheels; when spreading, it slides on the shoes, and in the load position only the wheels and blade are on the ground. According to the manufacturers, one man with six horses and a 7-foot scraper will handle as much dirt as three ordinary 4-horse Fresno outfits. These wheeled scrapers are made in A, B and C grades of strength for standard, heavy and extra heavy duty. They may all be used as drag scrapers with wheels removed.



The Atlas Scraper, the Wheels of Which Extend the Life of Blade and Bowl

MAKE BIG MONEY With Little SULLIVAN Hoists



How much money could you make with a 345-lb. portable hoist that would lift a ton or pull a 50-ton car? That's the SULLIVAN "Turbinair." Use it for hoisting materials, placing structural steel and stone, operating derricks, or pulling drag scrapers. Air, steam, or electric power.

Write for the picture book
"Handy Hoisting and Hauling"

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CABLE CUTTER

Operation takes less than one minute, one cut puts the seizing or whips on both ends at same time.



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Any grade or size of cable up to one-inch can be cut with great ease.

Your nearest jobber can supply you or write us direct

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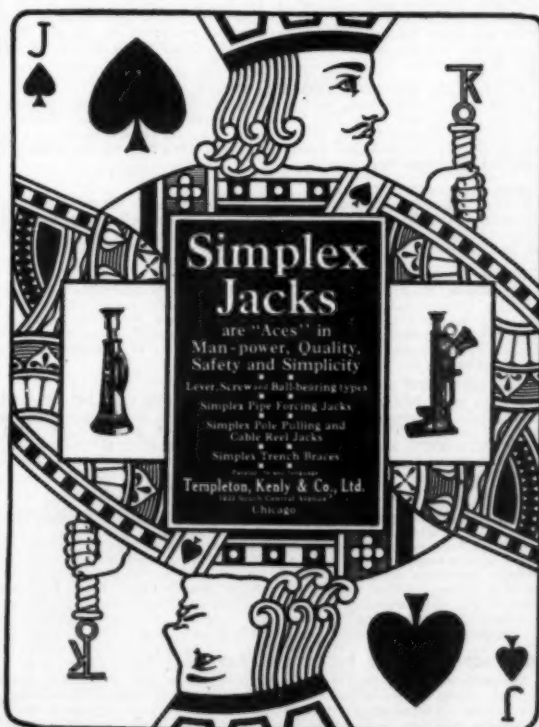
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F. O. B., S. F. Calif.

Horace Hills
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San Francisco
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Weights less than 7 pounds complete



Ask your contractor's supply house for
Simplex Trench Braces



Pays for Itself In Savings

Miami Earth Moving Equipment built for Fordson, Cletrac, McCormick-Deering and "Caterpillar" tractors is the most economical equipment available by all odds.

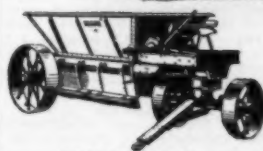
The Miami Scraper will easily pay for itself and tractor in a very few working days—unexcelled on short hauls.

Miami Trailers both bottom and rear dump in 2 to 5 ton capacities are 25% lower priced than others of similar construction.

Miami Bulldozer and Backfiller, operating from front and rear of tractor will close up more trench per day than any other equipment at near its price. Scraper, Bulldozer and Backfiller are power operated through the Miami Winch.

Get details on this equipment now—earn more money moving earth.

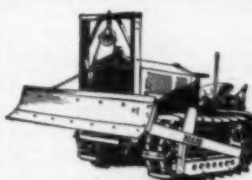
**THE MIAMI
TRAILER-SCRAPER CO.**
610 S. Clay St. Troy, Ohio



MIAMI TRAILER



STAKE PLATFORM TRAILER



MIAMI BULLDOZER

Write
for
Details

MIAMI and **power-SCRAPER**
Reg. U. S. Pat. Off.

Write
for
Details

Help for Contractors

These especially selected catalogs and pamphlets of value to contractors are for free distribution. You will find it worth while to check these lists each month and write for the catalogs you need.

HOISTS FOR CONTRACTORS

"Giant-line" hoists adapted to a wide variety of uses and especially suitable for contractors, are thoroughly described and illustrated in a catalog of The Brown Clutch Co., Sandusky, Ohio, which is free to interested contractors and engineers.

A NEW HEAVY-DUTY CRAWLER TRACTOR

A heavy-duty crawler tractor, the Cletrac "40," with a wide margin of reserve power beyond its standard rating, that has power and traction to handle the heaviest equipment, speed, ease of control, short turning radius and "one-shot" lubrication system, is described in a booklet of the complete Cletrac line of tractors, which The Cleveland Tractor Co., Cleveland, Ohio, will be glad to send on request.

A LIGHT ROLLER FOR THE SMALL CONTRACTOR

A light, small roller, its weight varying from 1½ to 2 tons, that is known as Model P-10 and is especially suited for construction jobs where the use of a large roller or a hand roller is impractical, and that is powered by a Continental Red Seal motor, is described in an attractive booklet of The Pierce Roller Co., Anderson, Ind.

GOOD ROADS

This is the title of a 4-page pamphlet of the Good Roads Machinery Co., Inc., Kenneth Square, Pa., which is issued monthly and which contains items of interest to contractors and engineers and descriptions and illustrations of the additions to the road machinery equipment line of this company.

28-DAY STRENGTH IN 24 HOURS

This is the result of a new development in concrete construction achieved by the use of Quikard cement, a product of the Ash Grove Lime & Portland Cement Co., Kansas City, Mo., which is discussed and illustrated in a catalog entitled "Quikard Cement."

EXPERIENCE WITH EXCAVATORS

This is the title of a booklet of the Harnischfeger Corporation, Milwaukee, Wis., which requires only 8 minutes to read, and which tells all about the P&H line of gasoline and diesel-driven excavators.

A GASOLINE-POWERED PAVEMENT BREAKER

A gasoline-powered pavement breaker, the Kodax, that costs less to own, move and operate, and that is simple and rugged in design, gasoline operated, weighing only 85 pounds, is described in a circular of the Milwaukee Gas Tool Corporation, Milwaukee, Wis.

A PORTABLE ELECTRIC HAND SAW

A new portable electric hand saw, Type-B "Wodack," which in addition to vertical sawing, provides for bevel sawing at any angle up to 60 degrees, and that has a G. E. universal motor of special design, is described in literature of the Wodack Electric Tool Corporation, 4627-4629 West Huron Street, Chicago, Ill.

DRILL STEEL SHARPENERS

Bulletin 4422 of the Ingersoll-Rand Co., 11 Broadway, New York, is a 32-page booklet that describes drill steel sharpeners and gives photographs showing the details of various important parts of this equipment, such as the crosshead, crosshead rod, piston, etc. This booklet also gives a two-page drawing of a practical blacksmith shop layout designed by Ingersoll-Rand engineers as a result of numerous inquiries from mine and quarry operators.

A MIXER ON CUSHION TIRES FOR FAST TRAVEL

A one-bag 7-S mixer, Model 7L-2R, that has been put on cushion tires for fast travel and that has a patented automatic skip shaker loader, is described and illustrated in Catalog No. T-28 of The Jaeger Machine Co., 701 Dublin Avenue, Columbus, Ohio.

A MIXER INCORPORATES NEW FEATURES

A new mixer that is automatic in its operation of loading and discharging, that can be turned around in its own length and has an automatic side loader hoist, is described in literature of Norris K. Davis, 400 Seventh Street, San Francisco, Calif.

A NEW TAR AND ASPHALT HEATER

A new 300-gallon tar and asphalt heater for highway maintenance work, that is an exclusive oil burning model, and has heat supplied by two Littleford torch burners is described in Bulletin D-14 of Littleford Bros., 485 East Pearl Street, Cincinnati, Ohio.

TAKE-UP TIE ROD CLAMPS

Simplicity in design and service, ease in installation, and economy in cost are the main features of Bulldog take-up tie rod clamps that are manufactured by the J. M. Willard Co., 1083 West 30th Street, Los Angeles, Calif., and described in literature of the company.

A METAL TIE AND SPACER

The "Form-Hold" metal tie and spacer that is easy to handle and reduces concrete form construction costs by saving materials and labor, is described in a circular of the manufacturer, the Concrete "Form-Hold" Co., Inc., Culver City, Calif.

A TELESCOPIC AXLE AND LEANING GRADER

You can figure labor lower than you've ever done before if you put an Austin leaning wheel grader with telescopic axle on the job. This rugged and profitable piece of equipment is described in an interesting booklet, "The Long and Short of It," which The Austin-Weston Road Machinery Co., 400 N. Michigan Avenue, Chicago, Ill., will send on request.

A SMALL, FAST HOIST

The new "Han-Dee" hoist that loads up to 500 pounds on a single line at a speed of 100 feet per minute, and 650 pounds at a speed of 75 feet per minute, and that is equipped with a 2-horsepower Fairbanks-Morse "Z" magneto-equipped gas engine, is described in an illustrated circular of the Dyrr Manufacturing Co., 378 Bickett Street, Huntington Park, Calif.

AN ECONOMY WIRE TIE

The Miller pre-made form tie for use in building forms for concrete work which, according to the manufacturer, Grannis, Rich & Co., 4000 Whiteside Avenue, Los Angeles, Calif., enables the contractor to save about three times the amount he pays for the ties, is described in a complete catalog on forms, which is available on request.

AN IMPROVED LOADER AND SHOVEL

The improved Lessmann high-lift loader and low-lift shovel are described in an attractive new circular issued by the Lessmann Loader Co., Des Moines, Iowa. Besides giving a complete description of these machines, specifications, etc., the circular tells how contractors and others have reduced their costs and revolutionized their methods with the Lessmann loader and shovel.

A STATIONARY MOTOR SAW

A stationary motor saw is described and illustrated in a pamphlet of the Creason-Morris Co., 18th Street and Allegheny Avenue, Philadelphia, Pa. In this machine, the saw is pulled to the lumber instead of the lumber being pushed to the saw, thereby reducing vibration of the motor and saving the effort of the operator.

HANDLING SAND AND ROCKS

A combination adjustable volumetric and weigh box in which both sand and rock are weighed or measured in the same 2-compartment batch box, and which enables the contractor to handle a large volume of material during the year, at lower cost per ton, with consequent greater profits, is described in a pamphlet of the Madsen Iron Works, Los Angeles, Calif.

A NEW 4-WHEEL TRAILER

A roller-type fifth wheel circle that permits easy operation and does away with weaving and snaking on the road, a drawbar attached to the outside corners of the forward end of the frame, automatic braking, safety chains and other features of the new 4-wheel trailer of the Lapeer Trailer Corporation, Lapeer, Mich., are described in detail in an illustrated circular of the company.

A PORTABLE OIL-BURNING HEATER

Lower cost, better work, and absolute temperature control is possible with the use of the Style "J" portable oil-burning heaters of Connerly & Co., 4000 N. Second Street, Philadelphia, Pa., which are made in capacities of 50, 75, 100 and 165 gallons, and are described in the little "Blue Book" of the company.

A BIG CAPACITY GRADER

A new big capacity grader for highways, streets, subdivisions, dams, reservoirs, cuts, fills and leveling, that is a triple-bucket dirt mover that speeds operations economically, is described in an illustrated circular of the Ball Wagon Co., Wilson and Scotts Avenue, Stockton, Calif.

A ROCK BREAKER AND GRANULATOR

An economy rock breaker and granulator that is adaptable to the size-reduction of practically all classes of material regardless of character, and will reduce input size to minus one-half-inch cubiform material by sufficient stage reduction, is described and illustrated in an advance bulletin of The Economy Equipment Co., Suite 644, I. W. Hellman Building, Los Angeles, Calif.

A POWER FLOW SCRAPER

A descriptive folder of The Garst Manufacturing Co., 549 West Randolph Street, Chicago, Ill., will be sent on request, to interested engineers and contractors. This folder describes a power flow scraper that is essentially a right and left hand plow joined at the rear and having a vertically adjustable cover plate which stops all over-digging and can be adjusted to increase or decrease the normal capacity.

REINFORCED CONCRETE CRIBBING

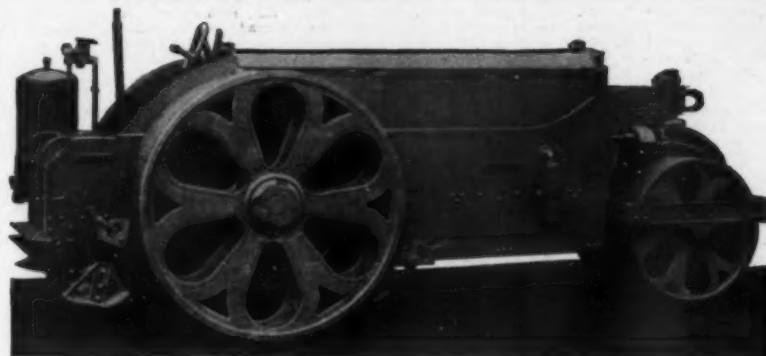
Catalog Supplement No. 23 of the Massey Concrete Products Corporation, Peoples Gas Building, Chicago, Ill., describes and illustrates reinforced cribbing which is especially adaptable along lines of heavy traffic, where interference to traffic is a very important consideration; and for outlying locations where it would be difficult to convey equipment for constructing monolithic walls; as well as for the extension of abutment wing walls; the extension of old masonry or monolithic concrete walls; retaining fill around signals, motor car setbacks, etc.; and retaining walls for supporting highway and for general construction work.

LATE MODEL, LOW PRICED MIXERS

A complete catalog of late model, low priced mixers, describing the new friction tilting device found exclusively on the new Kwik-Mix trailer and other desirable improvements in a line of mixers with capacities of ¾ to 2 bags, in addition to the new No. 3½ trailer, is available to contractors and engineers, on request to the Kwik-Mix Concrete Mixer Co., Port Washington, Wis.

A NEW 10-TON TRACTOR

Retaining in general all of the powered advantages of the 10-ton tractor of the Monarch Tractors Corporation, Springfield, Ill., a new 10-ton Model—"F" with some important improvements and new features is being produced by that company, and is described in literature of the company.



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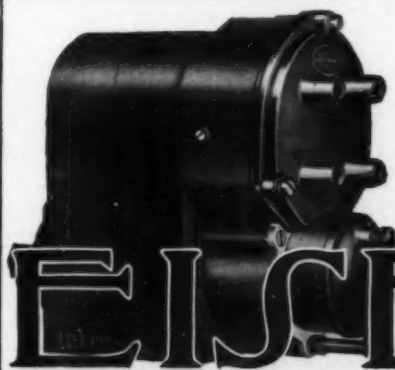


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SECTIONAL BELT CONVEYORS

The Conveyor Folder of the Barber-Greene Co., 495 W. Park Avenue, Aurora, Ill., describes and illustrates sectional portable belt conveyors that are easily and inexpensively set up, and that handle practically any bulk, semi-bulk, or sacked material over distances ranging to 300 feet, up to heights of 60 feet, or whatever local set-up permits.

PORTABLE COMPRESSORS

The Traylor 12 x 10-inch portable compressor that will operate five rock drills, 14 chipping hammers, or other pneumatic tools in proportion, and that is a horizontal type, double acting, slow speed, sturdy and reliable unit, is described in a booklet of the Cement-Gum Co., Inc., Allentown, Pa.

LOW-COST ROADS

Greater mileage of good, low-cost roads is possible with Tarvia, for road construction, repair and maintenance, made by The Barrett Co., 40 Rector Street, New York, and described in circulars of the company.

JOINTS THAT STAY TIGHT

All jointing materials are unnecessary, no bell holes need be dug, no lead need be poured, and there is nothing to deteriorate or work loose in the flexible machine-tapered iron-to-iron joints of Universal cast iron pipe, described in literature of The Central Foundry Co., Graybar Building, 420 Lexington Avenue, New York.

A NEW 1 TO 1 1/4-YARD GAS SHOVEL

"The Master Shovel," a booklet of The Byers Machine Co., Ravenna, Ohio, fully describes the new Byers-Maasillon 1 to 1 1/4-yard shovel which has met with wide favor in the construction field. This booklet is available to interested contractors and engineers.

A TRUCK FOR HANDLING CEMENT

An efficient truck for handling cement, plaster, lime, and other pulverized commodities in cloth and paper bags, that is sturdily built and substantial in every way, weighing 82 pounds, is described in an illustrated circular which the Bates Valve Bag Corporation, 35 East Wacker Drive, Chicago, Ill., will send on request.

A PAVEMENT TESTING CORE DRILL

A new core drill for testing completed concrete pavements, that is operated by a gasoline engine, weighs 772 pounds, is mounted on the rear of a truck and drills a 6 3/8-inch hole, removing a 6-inch core at the rate of one foot in 15 to 20 minutes, is described and illustrated in Bulletin No. 85-A of the Sullivan Machinery Co., 162 S. Michigan Avenue, Chicago, Ill.

A PORTABLE LIGHTING UNIT

A portable acetylene flare light that is extremely powerful and operates under all climatic conditions has been added to the line of the Oxweld Acetylene Co., 30 East 42nd Street, New York, and is described in literature which the company will be glad to send on request.

A WINCH FOR PULLING OUT Mired TRUCKS

A winch which applies to the rear axle of a motor truck and operates without jacking up the rear wheel, is described in S. E. Letter No. 234 of the Braden Steel & Winch Co., Tulsa, Okla., and will be sent on request to interested contractors and engineers.

CHEAP LIGHTS FOR CONSTRUCTION CAMPS

An automatic light and power unit, Model-D, that generates 1500 watts, sufficient for sixty 25-watt lamps or seven 200-watt flood lamps, that starts when you turn on the switch or any electric light bulb or appliance, and that will also furnish electric power to run pumps, compressors, etc., economically and dependably, is described and illustrated in circulars of the Kohler Co., Kohler, Wis.

A NEW GASOLINE SHOVEL

A new gasoline shovel of the full revolving type and fully convertible to dragline, back hoe, clamshell and crane service is described in literature of The Ogden Co., Marion, Ohio. It is known as the Conqueror, and is mounted on a new and improved continuous tread truck frame of the double-chain drive type.

DUAL WHEELS FOR A 1-TON TRUCK

Dual, pneumatic Webster wheels for Ford and Chevrolet trucks, that are built to permit the application of standard makes of brakes and that enable the unit to work out to maximum advantage on such work where the going is over soft ground, when extension frames are used with the truck where the loads are too great for a single tire, are described in an illustrated circular of Whitehead & Kales Co., Detroit, Mich.

READY-BUILT STEEL FORMS

Blaw-Knox universal forms for concrete curb, gutter, integral curb and sidewalk construction, that meet the exact cross section of the work, remain smooth and true, insure speedy erection and do away with refinishing, are described in an illustrated folder of the Blaw-Knox Co., 667 Farmers Bank Building, Pittsburgh, Pa.

4-CYLINDER MOTOR ROLLERS

Huber 4-cylinder, automotive-type motor rollers that are active and easy to handle, have low center of gravity, and that are made in capacities of 5, 7, 10 and 12 tons, with or without scarifier attached, are described and illustrated in an attractive new catalog of The Huber Manufacturing Co., 330 Center Street, Marion, Ohio.

TRACK MATERIALS AND STEEL POST SECTIONS

A general catalog has been published by the Sweet's Steel Co., WilliamSPORT, Pa., on light rails, track materials, a complete line of track accessories, high carbon-rail steel angles, etc., as well as a pamphlet announcing the rolling of flanged leg channel sections and high carbon steel posts manufactured therefrom and their adaption to snow fence, sign and route marker posts, etc.

A COMPACT, 2-CYLINDER POWER UNIT

A 2-cylinder, Model P-10 power unit, equipped with the Model Y-2 motor, of the Continental Motors Corporation, Industrial Equipment Division, Muskegon, Mich., that has a power range of from 8 to 14 horsepower, and is designed for all-around use where space is limited, is described in literature which the company will be glad to send on request.

A NEW WELDER TRACTOR COMBINATION

An improved combination of electric arc welder and Fordson tractor that consists of a standard Fordson tractor, belt-connected to a Type WD-300-A, 25-volt, 300-ampere one-hour rated 1750 r. p. m., ball-bearing generator, is described in literature which the General Electric Co., Schenectady, N. Y., will send to contractors and engineers.

A NEW NON-TILT MIXER WITH NEW FEATURES

A new non-tilt Wonder mixer that requires no struts to stabilize it when at work, that comes to the job ready to pour well-mixed concrete, and that will turn in a 20-foot radius, is described and illustrated in a new catalog of the Construction Machinery Co., 447 Vinton Street, Waterloo, Iowa.

EXTRA RESERVE MOTORS

A 16-page catalog of The Stearns Motor Manufacturing Co., Ludington, Mich., describes and illustrates the Stearns extra reserve motors for 2 to 3 and 3 to 4 ply tractors and for motor trucks, that will give working ability to meet any emergency, and long and satisfactory service.

AN AUXILIARY BACK-UP CONTROL FOR SCRAPERS

An auxiliary back-up control that is designed for Models 264 and 265 Schaefer automatic tractor scrapers, that requires no operating levers, provides universal action in the forward position and that adds to the usefulness of the scraper in crowded places and in getting in around trees, etc., is described in an illustrated circular of The Gustav Schaefer Wagon Co., 4180 Lorain Avenue, Cleveland, Ohio.

A NEW HOIST FOR LIGHT TRUCKS

A new H-2 Hydro hoist which affords light-duty power for operating dump equipment and that has the same advantages as the heavy-duty dumper, with a dumping angle of 56 degrees and a speed of a full-load dump in 5 to 9 seconds, is described in literature which The Heil Co., 1242-60 26th Avenue, Milwaukee, Wis., will be glad to send on request.

A STURDY, SMALL SHOVEL-CRANE

A sturdily built small machine of 3/4-yard shovel dipper or 6-ton crane capacity, Type-CC, that is convertible for use with dragline or trench hoe attachments, is described in Booklet 281 of the Industrial Brownhoist Corporation, Cleveland, Ohio.

A HEAVY-DUTY PORTABLE PAVEMENT BREAKER

A practical portable pavement breaker that consists of a 200-foot Chicago Pneumatic air compressor mounted on a Mack 3-ton truck, and that will break out 500 lineal feet of pavement per hour in widths from 6 inches to 10 feet wide, is described in literature of The Rapid Pavement Breaker Corporation, 1714 1/2 Garfield Place, Los Angeles, Calif.

A TAMPING ROLLER

A tamping roller that consists of two rollers, 48 1/4 inches in diameter and 4 feet long, with 119 cast iron tamper feet with ball-shaped heads on each roller, that gives a complete compacting surface, is described in a circular of the Western Pipe & Steel Co., Los Angeles, Calif.

STRONGER CONCRETE CONSTRUCTION

Great strength, speed in hardening, uniform curing throughout the entire thickness of the concrete, and the distribution of moisture are but a few of the features of calcium chloride described in an attractive booklet of The Solvay Sales Corporation, 40 Rector Street, New York, on the uses and advantages of Solvay calcium chloride in concrete construction.

A MOTOR-DRIVEN WELDING MACHINE

A one-arc motor-driven welding machine, Model-S, ranging from 10 to 300 amperes, is described and illustrated in Bulletin No. 1-D of the Wilson Welder & Metals Co., Inc., Wilson Building, Hoboken, N. J.

A TURBINE AIR ADJUSTABLE SAW

A light, portable machine that is furnished with an 8-inch circular saw and that is easily adjustable to any cut from 3/4-inch to 2 inches in depth, and that is driven by a turbine air motor that develops from 2,700 to 4,400 r.p.m., is described in "Turbine Air Tools," a booklet published by The Tousey Tool Co., 1965 East 66th Street, Cleveland, Ohio.

A NEW SECTION FOR STEEL SHEET PILING

An addition to the line of Lackawanna steel sheet piling of the Bethlehem Steel Co., Bethlehem, Pa., is a deep arch-type section, designated as Section No. DP165. This section, of 16-inch width, 3/4-inch web thickness and weight per foot of pile 33.3 pounds, is described in literature of the company.

A NEW ELECTRIC HAMMER

A new electric hammer that strikes 2300 sharp, hard blows a minute, weighs 15 1/2 pounds, is simple in operation, and reduces labor costs and time in operation, is described in literature of the Black & Decker Manufacturing Co., Towson, Md.

AN IMPROVED HYDRAULIC JACK

The improved Pedersen Oiljack that is available in a full utility range of sizes to meet every need of engineers and contractors, that saves time, trouble and expense, and does not require periodical refilling, is described in an illustrated folder of The Oil Jack Co., Inc., 15 Park Row, New York.

BETTER BALANCED, STRONGER WHEELBARROWS

A new catalog has been issued by the General Wheelbarrow Co., headquarters for wheelbarrows, concrete carts, steel mortar boxes, scrapers, salamanders, etc., 3140 East 65th Street, Cleveland, Ohio, which describes the line of this company and will be sent on request.

PAVING BREAKERS FOR DIFFICULT JOBS

Three paving breakers that were chosen for the demolishing of High Bridge over the Harlem River, N. Y., on account of their speed, power and lack of vibration, are described in literature which the Independent Pneumatic Tool Co., 600 W. Jackson Boulevard, Chicago, Ill., will be glad to send to interested parties.

AN AIR-OPERATED SAWING MACHINE

An air-operated portable timber sawing machine which has a capacity for timbers up to 24 inches in diameter and weighs only 95 pounds, has been developed by the Reed-Prentice Corporation, Worcester, Mass., from which complete information may be secured.

HAVE YOU A BOILER PROBLEM?

If you have a boiler problem that requires attention get in touch with Johnston Bros., Inc., Ferrysburg, Mich., who specialize in boilers for contractors' equipment, and who will be glad to send information and literature on request.

NEW LEANING WHEEL GRADERS

Two new leaning wheel E-Z Lift graders, Nos. 77 and 78, that are smaller, lighter machines of sizes for 7- and 8-foot mouldboards, and have all the features of the larger machines, including the Simplex pivotal frame adjustment and E-Z Lift gearing, and important improvements in their large sizes, Nos. 10 and 12, have been described in literature of The Galion Iron Works & Manufacturing Co., Galion, Ohio.

